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Electric Traction in Great Britain.

Two years ago the electric traction industry was looming very large in Great Britain. There appeared every prospect of a large business being done; indeed, the business is already large, but it bears no comparison to what it promised two years ago to be. In that time the many municipal authorities throughout the country have seized upon the industry and practically throttled it. "Tramways" never have prospered in Great Britain because the legislation connected with them was of such an order that prosperity was impossible. The promoters of any tramway were practically ordered to sell the undertaking in twenty-five years' time for what was simply old iron price, and, as one writer put it, they took good care to have nothing but old iron to sell. In other words from its birth a tramway was allowed to run itself to death, and as there was no intention to maintain in order anything to be sold for old iron, the line, cars and equipment generally became dirty, noisome and generally dilapidated.

With the light railways act, better things were hoped for, and the advent of electricity appeared to open up a brighter prospect. Unfortunately, however, the municipal authorities have fastened upon the industry. They object to the construction of tramways excepting by themselves. The result is that as all English boroughs are of very limited area, and municipalities can work only within their own boundaries, the provision of any line requiring more than a few cars to work it is possible except in the large cities like Manchester or Glasgow. Interurban traffic that might be developed to an enormous extent is checked and the country is cut up into a lot of little borough areas with little prospect of much outside connection. Interurban lines will not grow because, while the boroughs take possession of the good-paying spots, private enterprise is hardly likely to go to the extent of filling up the thinly populated areas between.

It is now evident that unless there be a change in the attitude of local authorities the tramway industry of Great Britain will again be flung back into the nothingness from which it had just commenced to emerge.

It may be laid down that tramway development cannot be a success in England unless carried out in a broad-minded manner to connect towns and villages upon a network of lines worked by one authority or proprietorship. All evidence points to the fact that small power stations cannot be worked economically nor can small mileages. Despite the fact that England is one of the best possible fields for tramway enterprise, engineers are deploring the fact that they cannot obtain remunerative employment on electrical traction work and the industry is already becoming of the same nature as the old tramway industry, which died of legislation, the killing effects of which are now replaced by municipal control and the inevitable mismanagement that seems to attach to a good deal of such control.

As the process seems to be extending, it is suggested that if private enterprise is to be completely choked, it would be much better to hand over the whole system of tramways in a county to the county authorities, rather than to the smaller local authorities. There would then be some prospect of working systems on an extensive scale with economy. It would, of course, be far better that the whole country should be divided into districts and each district placed under a board of management which should work the tramways in a commercial manner at low profits, but not at absurdly low rates, the surplus being expended in necessary improvements and extensions. In such a system the fact that an outlying branch did not pay ought not to be held to justify its stoppage. It is just because the villages and back districts have such poor facilities that they do not prosper, are not held to be desirable places of residence and become deserted.

The large prospective amount of trade that might be done by American firms in English traction work makes this a question of considerable importance to Americans and is quite sufficient to warrant attention being drawn to it.

We here in America have undoubtedly gone to the extreme in allowing "private enterprise" to have its own way in these matters utterly regardless of public rights, and of course these rights can be safeguarded without going to the other extreme, as they seem to be doing in Great Britain. Consideration of public rights in these matters of urban and suburban rapid transit does not demand that the roads shall be built or operated by public officials, but does require that the immediate and prospective value of a franchise shall be taken into account and that for this franchise, necessarily a monopoly, the company operating the road shall give something in return and not, as has too often been the case here, be allowed to build and operate the roads practically without conditions of any kind.

The Dieterich Speed-Varying Device

Discussions of technical subjects in the daily papers are not usually worthy of consideration, except for purposes of amusement. The Providence "Journal," however, is an exception to this rule, as it uniformly discusses such subjects with an intelligence which is in refreshing contrast with that usually shown by the daily press. In a recent issue of that paper we find the following remarks about the Dieterich speed-varying device, as applied to bicycles, which was described in our issue No. 47, of last year:

"One who has encountered steep hills and pushed against head winds appreciates the desirability of a low gear under such conditions; he is ready to sacrifice speed for power. But on the level or where the wind is favorable, a high gear is much better; a machine geared to 80 or 84 is preferable to one geared to 60 or 70. The variable gear in good working order will meet the requirements of hill work, but on a level road it is by no means certain to be satisfactory. The majority of riders enjoy speed where road conditions permit, and increased speed requires power. As power is applied to the pedals, will the gear not be lowered automatically, so that

the harder the cyclist works to get up speed the slower he will go, because of the unavoidable reduction of gear? This question has not been put by any of the writers who have discussed the variable gear. A statement, therefore, from one who has used a bicycle fitted with this gear, will be very interesting."

As the action of the gear under the conditions assumed in the above is somewhat obscure, we sent a clipping containing the criticism to Mr. Dieterich, and in due time received the following reply from him:

Editor American Machinist:

The critic accepts the fact that increased resistance decreases the gear; he will furthermore find, if he takes the time to peruse the article in your paper, that power and resistance act opposite each other, and that while the power tends to shift the floating ring in one direction, the resistance produces a diametrically opposite shifting tendency. If, therefore, the power is increased, it will bring the floating ring in a more eccentric position and thereby increase the speed of the wheel. If that is not the case, as the writer of the criticism thinks, then power and resistance would have same tendency, and no change of resistance would bring change of speed, which fact, however, was accepted by him. I believe this short logical equation will help to disperse the wrong impression as cited in the Providence "Journal," and I would be glad if the writer of the criticism would give me his address, enabling me to give him more detailed and practical proofs, which would take too much space in the "American Machinist."

The fact is, that with constant crank revolution and pedal pressure, the gear increases with a decrease of resistance, and *vice versa*. The fact is, furthermore, that with constant resistance the gear increases and decreases with the pedal pressure (and of course also with number of crank revolutions).

The efficiency has been shown to be, for a set value of the gear, and varying with this value, from 2 to 7 per cent. less than the best bevel gear drive; but I want to mention that these figures have been obtained from a hub (drawing of which you published) that had done rather long service, and which was not in "fixed-up" condition as the competitive bevel-gear machine. L. M. Dieterich.

The Ingersoll-Sergeant Drill Company, of New York, is issuing a statement concerning an effort now being made by the sugar interests of America to have the Secretary of the Treasury abrogate the clause in our reciprocal arrangements with Russia under which beet sugar imported from Russia comes in under a schedule of rates somewhat lower than would be imposed by the Dingley tariff rates, Russia, of course, giving our products exported to Russia special rates in return under what is known as the "favored nation" arrangement. The company named believe that if Russian beet sugar is discriminated against at the behest of the sugar trust Russia will certainly abrogate the present arrangements by which American machinery goes into Russia at lower rates than would otherwise be accorded it, and that this would be very much against the interests and rights of American machinery builders and the men employed by them. The Ingersoll-Sergeant Company urge that the National Association of Manufacturers should take action to prevent if possible the consummation of the scheme.

Meeting of the Junior Mechanical Engineers—The Vanderbilt Locomotive Boiler.

The second meeting for the season of the local Junior organization of the American Society of Mechanical Engineers, which was held at the house of the society, January 8, was a decided success, both as to the attendance and as to the interest manifested. A sudden accession of desire for information concerning locomotive boilers—or some other cause—so crowded the meeting room that many were unable to obtain seats, an unprecedented record for a junior meeting. Mr. Cornelius Vanderbilt read a paper on the development of the locomotive boiler, and especially upon the Vanderbilt type of locomotive boiler, as designed and put into successful operation by himself. Mr. Vanderbilt said at the beginning, and probably with considerable truth, that "the locomotive boiler was developed less since its inception than any other important invention." This might mean that it was started so well at the beginning that opportunity was barred, or it might mean something else. The Vanderbilt furnace is of course a radical departure from the rectangular or parallel-sided furnace. The principal argument for the former is in its dispensing with the numerous staybolts of the latter, and the avoidance of the consequent dangers, delays and expenses attributed to them. The paper described some of the details of construction, and working drawings of several boilers were shown on the screen, these resembling each other so closely that little benefit was derived from their repetition. Photographs also of the various engines were shown. The paper gave, apparently with perfect fairness and with marked absence of inventor's bias, the results of various tests, which were quite favorable to the Vanderbilt boiler. The speaker showed himself perfectly familiar with locomotive practice, and gave a good impression of himself as a promising young engineer.

The highest praise that was bestowed upon the speaker at the meeting was contributed by Mr. Angus Sinclair, who said that "the experiment is the boldest of the kind the world has seen in regard to locomotive boilers. Mr. Vanderbilt has proved the value of some theories that I had thought impracticable. I think that his work deserves the praise of the engineering world." Mr. Forney spoke in a general way of the perennial controversy between himself and Mr. Sinclair concerning locomotive furnaces, the combustion of coal, grate surface, combustion chamber capacity and locomotive practice in general. Mr. Warren E. Hill, of the Continental Iron Works, spoke of the rolling of the Vanderbilt corrugated furnaces. He said that they were the largest ever made, and too long for their rolls, so that some of them had been welded in the middle. New rolls had, however, now been built which would work to a length of fifteen feet, and, while the greatest previous depth of the corrugations had been an inch and a half, this could now be increased to two inches, so that the thickness of the metal could be somewhat decreased.

The next junior meeting will be held on the first Tuesday in February, when Mr. John C. Wait will speak again on the law of contracts. The first address upon this topic was, as we indicated at the time, one of great interest as well as profit to every one present, and the second cannot fail to prove so, and a large attendance should be assured.

Legal Notes.

BY WILLIAM MARSTON SEABURY.

WHAT CONSTITUTES "SATISFACTION."

In connection with the case of Williams Manufacturing Company versus Standard (53 N. E. R. 862), recently discussed in our columns, it will be interesting to note the decisions of some of the States other than Massachusetts upon the same question.

In the Massachusetts case referred to, it was held that where a party agreed with another to construct a certain machine or plant to the "satisfaction" of that person, the contract would not be considered to have been performed unless the person to be satisfied was actually satisfied with the work, no matter how unreasonable his dissatisfaction might be, so long as he acted in good faith. In New York we find a decision by the court of last resort, in the case of Duplex Safety Boiler Company versus Garden *et al.*, expressing views diametrically opposed to those contained in the case decided by the Massachusetts court. In the New York case the plaintiff sued to recover $700, the agreed price of materials furnished and work done for the defendants, at their request, upon certain boilers owned by them. The agreement of the parties was contained in letters, one of which specified that "For above changes we are to pay you $700, as soon as we are satisfied that the boilers as changed are a success and will not leak under a pressure of 100 pounds of steam." This letter was written by the defendants, and the propo-

sition contained in it was accepted by the plaintiff. On the trial of the case, the jury found a verdict for the plaintiff, and from the judgment the defendant appealed to the Appellate Division, and upon the affirmance of the judgment by this court, the defendant appealed to the Court of Appeals. The Court of Appeals, in its decision written by Justice Danforth, held that in the case then before it for determination, a different rule should be adopted from that which prevailed where the object of the contract was to gratify taste, serve personal convenience or satisfy individual preference, in which cases the satisfaction of the party may properly be a matter to be determined for himself alone. In distinguishing the cases Danforth, J., said, "In the case before us the work required was specified and was completed; the defendants made it available and continued to use the boilers without objection or complaint. If there was full performance on the palintiff's part, nothing more could be required, and the time for payment had arrived; for, according to the doctrine of the above cases, 'that which the law will say a contracting party ought in reason to be satisfied with, that the law will say he *is* satisfied with.'" The judgments of the lower courts were therefore affirmed. (101 N. Y. 387.)

In the case of Wood Reaping & Mowing Machine Company versus Smith, the Supreme Court of Michigan passed upon a similar question to that just discussed. In this case the plaintiff agreed that the contract for the sale of a mowing machine should be of no effect unless the machine worked to the defendant's satisfaction. The evidence as to the action of the machine was conflicting, there being testimony tending to show that it performed its work badly and other testimony to the effect that it worked remarkably well and that the defendant had acknowledged to third persons that he was satisfied with it. After a trial of the machine defendant refused to accept it, upon the ground that it did not satisfy him. On the trial of the case the Justice rendered judgment for the plaintiff, and the defendant appealed. The Appellate Court recognized the fact that two distinct classes of cases involving this same question existed, under one of which the case at bar must fall. One class is where the feelings, taste or sensibility of the promisor are involved, and not "those gross considerations of operative fitness or mechanical utility which are capable of being seen and appreciated by others"; and the other class is where the promisor is supposed to undertake that he will act reasonably and fairly, and found his determination upon grounds which are just and sensible, and which grounds are subject to judicial determination. In reversing the judgment of the lower court and granting the defendants a new trial, Chief Justice Graves said: "To which of these classes does this case belong? The answer is not difficult. The facts are very distinct. The plaintiff's own evidence is cogent that the defendant was extremely shy, and would enter into no arrangement except upon the terms of doing as he liked about keeping the machine after testing it. His mind was fixed immovably that no chance should be left to force the article upon him unless he finally chose to take it; and the special stipulation was especially drawn and executed to meet the purpose and thereby induce the defendant to concur in an arrangement. Had it been the intention that he should be liable in case the performance of the machine was such, in the opinion of a jury, as to deserve his approval, it would have been quite unnecessary to get up the special writing. . . . The transaction was one belonging to the first class, and the circuit judge was mistaken in deeming it otherwise." (50 Mich. 565.)

Commercial Review.

NEW YORK, Saturday, Jan. 12.

MACHINE TOOLS AND OTHER MACHINERY.

A strong tone still prevails in the tool market. The year 1900 went out with a sharp uplift from the depression which had characterized it during the summer and most of the fall. Despite the dearth of export trade, manufacturers generally managed to take on enough work by the close of the year to make them cheerful, and such a volume of inquiry developed as to give every indication of good business for the coming year. The fine feeling mentioned is distinctly to be perceived among the manufacturers in the State of Ohio. A little check on the accuracy of this is as follows: The correspondent heard a report that a certain Ohio manufacturer, unnamed, had described in graphic terms the deplorable lack of orders. Being somewhat conversant with the reported trade situation of the various tool builders of that State, as well as with their temperamental view points, a guess was ventured as to the identity of the party referred to, and it proved to be the right one.

In the two weeks of the new year already spent, no additional features have come to light in New York machine-tool offices. The prevailing good inquiry has not led to any unusual closing up of contracts, and the season seems to have been a little early for buyers to crowd in with alacrity. Business is steady with good prospects and there is some belief that 1901 will prove a better year than 1900. The number of important enterprises in the wind that are known to us and which either are now in the market for tools or may be expected to be later on seems extraordinary. Prominent among them are engine-building plants in the Middle West, railroad shops in the East and Far West and steel-car plants in the North and South.

The German tool trade situation is looking no better for American builders than when we thoroughly covered it during the fall by authoritative interviews. Having crowded Americans out of their own country, the German manufacturers have begun to cut into the English and Belgian markets. This competition is not limited to Ludwig Loewe & Co., who have long had a store in London. The decrease in American exports of metal-working machinery is getting to be very apparent in the government statistics, a table of which is published herewith. Shipments for the month of November, 1900, which naturally correspond to orders taken some time previous, show a falling off of nearly one-half as compared with the valuation for November, 1899. The total for the year 1900 to date, which, owing to heavy shipments in the early months, has hitherto kept ahead of 1899 to a similar date now lags behind. The total for 1900 will be heavy, probably over $6,000,000, but with the situation at the close this will afford little comfort to the tool builder. There is a slender ray of encouragement in the report of a man just come from the other side that the English field is now in a favorable state for cultivation owing to the amount of electrical work that will require machine tools. Among such work the British Westinghouse plant, of course, stands pre-eminent. The contracts that may be expected to result from it will go far to make deficiencies in future export totals. So many people are bidding, however, that probably the margins of profit may be narrow. A representative of an English tool firm who is now in this country is said to have come here partly to keep in touch with these contracts. It has been suggested that there will be foreign competition to secure them.

It is worthy of note when the buyers of a particular tool or machine are in large proportion old-established concerns. We were rather struck by the extent to which this has been the case with recent sales of the semi-automatic turret lathes of the American Turret Lathe Company. Over fifty of these machines have been sold in about eight weeks past, and among the buyers are many such names as E. P. Allis Company, Worthington Pump Works, Lunkenheimer Company, Cooke Locomotive Works, Gates Iron Works. A number who are machine-tool manufacturers themselves are among the purchasers—such as Wm. Sellers & Co., Bement, Miles & Co., the Bickford Drill and Tool Company, Cincinnati Milling Machine Company and others. The company is preparing to bring out some new machines, among which are a bar machine for a bar 2¾x36 inches and a combination engine lathe and turret machine having a friction back-geared engine lathe head. These machines will be on the market in a few weeks.

There are ways of conducting the machine-tool business and yet again there are other ways. One way is that followed by

a Western tool builder in a certain transaction with a New York selling house. The selling house had bought a particular machine of the builder and subsequently wired him for a price on another one. If the inquiry had come by mail the manufacturer would not have asked an increased figure, but a telegram denotes anxiety and experience had taught him that anxiety leads to sales. He therefore added $25 to the price which he would otherwise have charged, with the remark, "That telegram has cost the sender $25."

CHICAGO MACHINERY MARKET.

The outgrowth of plant capacity is not confined to street railway companies and other users of large units, though they perhaps furnish the most shining examples of that condition. Representatives of power manufacturers, who are tolerably familiar with the machinery situation in the West, say many plants only five years or so in age have outlived their economical usefulness. When constructed they were fully up to any reasonable demands in sight, but, surprising to the owners, these plants are now too small. Much of the work now in prospect is the outfitting of these prosperous industries with a new equipment of power.

Among the big users of steam and electricity, plans for enlargement follow plans so rapidly that before one can be put into effect one or two others have already started on the way. Many plans of this kind are now brewing in the offices of consulting engineers. A site was secured a few days ago by the Chicago Street Railway Company upon which it is expected later on to erect a centralized power plant for the operation of all the South side lines. The franchises of the company, however, require a little looking after, some being soon to expire, before a work of this magnitude is undertaken. The Chicago Edison Company also have some improvements of great magnitude in contemplation. Expected needs two years hence have to be considered, owing to slowness in procuring the high units of power.

Another branch of trade that opens the new year with flattering prospects is municipal work. There are many improvements by cities, towns and villages that from present appearances will be undertaken soon. One of the most ambitious for a city of its size in the West is the proposed water-supply system for Grand Rapids, Mich., bids for which are to be opened February 15. It is proposed to bring water for the city from Lake Michigan, a distance of thirty-five miles, through a 48-inch pipe and raise it 250 feet. The cost is estimated at $4,000,000, and 25,000 horse-power, it is said, will be required.

Among the smaller users of power, the furniture makers in this city are now brisk buyers of enlarged power and machinery. Last year was the most prosperous in seven or eight and long-needed repairs and improvements are under way.

The Heine Safety Boiler Company has sold ten boilers of 647 horse-power each to the Chicago Edison Company; one of 250 horse-power to the Dallas (Tex.) Cotton Mills; two of 275 horse-power to a concern in Houston, Tex.

Machinery, Machines, and Parts of—	NOVEMBER— 1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.	11 MONTHS ENDING NOVEMBER— 1898 Number.	1898 Dollars.	1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.
Cash Registers	....	61,185	1173	91,068	....	*	....	*366,752	....	752,959
Electrical	....	303,476	...	402,293	....	2,276,197	....	2,757,986	....	4,057,308
Laundry Machines	....	31,066	....	30,517	....	*	....	*147,899	....	442,399
Metal-working	....	599,406	....	308,571	....	5,321,866	....	6,092,270	....	5,855,178
Printing Presses, and parts of	....	134,533	....	70,957	....	738,384	....	922,620	....	1,137,279
Pumps and Pumping Machinery	....	246,695	....	201,627	....	2,014,471	....	2,712,109	....	2,572,579
Sewing Machines, and parts of	....	427,148	....	314,130	....	2,824,635	....	3,688,547	....	4,173,955
Shoe Machinery	....	83,465	....	63,409	....	854,365	....	876,403	....	956,373
Steam Engines, and parts of—										
Fire	1	8,135	2	547	7	6,588	4	21,848	13	24,625
Locomotive	28	271,500	19	140,785	549	4,922,189	462	4,544,350	398	4,061,887
Stationary	91	68,270	73	82,984	472	324,711	806	456,027	1190	761,909
Boilers and parts of Engines	....	168,279	....	131,443	....	1,087,316	....	1,304,565	....	1,749,416
Typewriting Machines, & parts of	....	215,107	....	242,160	....	1,893,333	....	2,533,118	....	2,504,388
All other Machinery, and parts of	....	1,837,143	....	1,883,243	....	14,215,775	....	17,772,158	....	21,884,195

* Not separately stated prior to July, 1899.

UNITED STATES OFFICIAL STATISTICS OF MACHINERY EXPORTS, INCLUDING NOVEMBER, 1900.

The E. P. Allis Company has sold an engine of 3,500 horse-power to the Toledo (Ohio) Traction Company and one of 2,500 horse-power to the Cincinnati Electric Lighting Company. The demand for blowing engines is greater than can be filled. An inquiry this week is for a 2,500 horse-power engine for a copper smelting plant in Tasmania.

CINCINNATI REPORT.

From a news standpoint this period reveals the least activity in machine-tool making and allied lines for a year or more. The deal whereby the British Westinghouse Company is expected to purchase a big assortment of machinery is reported still on with many concerns anxious for favors.

The Cincinnati Milling Machine Company reports a fair domestic business. This company made a substantial sale of milling machines in Pittsburgh during the week.

The John H. McGowan Company, manufacturers of pumps, is building an addition to its already large works. This will include steel erecting shops and the installation of a number of big traveling cranes.

The Westinghouse Electric and Manufacturing Company has captured the contract for the power equipment of the Columbus & Buckeye Electric Traction Company; the amount is in the neighborhood of $160,000. The main power house is to be a handsomely equipped one, located at Hebron, midway between Columbus and Newark, Ohio.

Quotations.

NEW YORK, Monday, Jan. 14.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$16 50 @ $17 00
No. 2 X foundry	15 75 @ 16 00
No. 2 plain	14 75 @ 15 25
Gray forge	14 00 @ 15 00
Alabama Irons:	
No. 1 foundry, or soft	15 25 @ 15 75
No. 2 foundry, or soft	14 50 @ 15 00
No. 3 foundry	13 75 @ 14 25
Foundry forge, or No. 4	13 25 @ 13 75

Bar Iron—Base sizes—Good standard brands from store, 1.75 @ 1.90c.; mill prices on dock, 1.50 @ 1.60c.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. upward.

Machinery Steel—Base sizes—From store, 1.70 @ 1.80c.

Cold Rolled Steel Shafting—Base sizes—From store, 2.50 @ 2.75c.

Copper—Lake Superior ingot, in carloads, 16⅞ @ 17c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c.

Pig Tin—26½ @ 26½c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½c. extra for carloads.

Spelter—4.10 @ 4.15c., New York.

Antimony—For 5-cask quantities Cookson's is about 10½ @ 10⅝c.; Hallett's, 9c., and U. S., 9.10c.

Lard Oil—Prime city, in barrel lots, prompt delivery at 67c., and 1 and 2c. less for larger quantities and late deliveries.

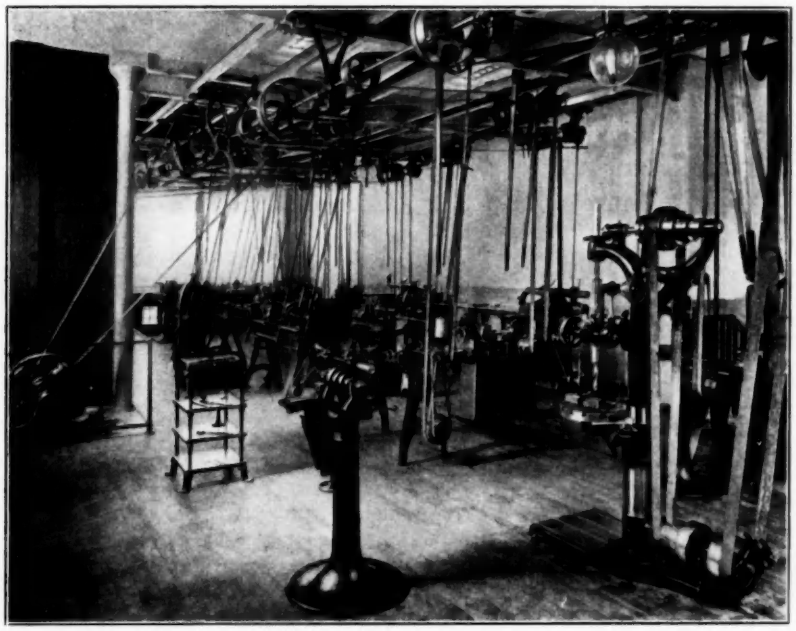
Professor Howe, the prominent American metallurgist, has sent the secretary of the Société d'Encouragement pour l'Industrie Nationale, in France, a check for $500 to be used for a prize awarded according to discretion, but with the suggestion that it be given for a course of research useful to the scientific study of the metallurgy of iron, preferably devoted to the discovery of a new compound of steel or other alloy of iron, or to improvements in the means of identifying the microscopic compounds already known in the alloys of iron.

Inquiry for Machinery.

(139) A manufacturer in Switzerland wants names and addresses of makers of machines for numbering watch cases and watch parts or similar small articles.

London Show Rooms of Ldw. Loewe & Co.—Some Engineers in the Berlin Shops.

The first of the accompanying engravings looks as though it might have been made from a photograph taken in a shop, and as a matter of fact it is intended to look as though it were a shop, although it is not—but a machinery show-room; the London show-room, in fact, of Ldw. Loewe & Co., of Berlin. The idea in arranging this, we presume, has been to have the machines exhibited under as nearly working conditions as practicable. All of them are belted and work can be done with them in the way it is intended to be done when they are in the shop.



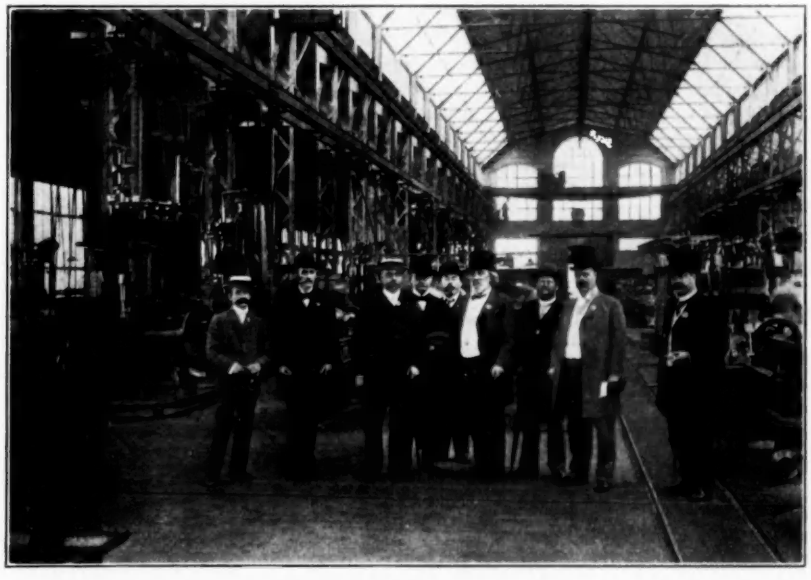
LONDON MACHINERY SHOW-ROOM OF LDW. LOEWE & CO., OF BERLIN.

We are convinced that this is the proper way to exhibit machine tools. In these days of electric motors it can usually be arranged for without much difficulty and the plan is one which we think might be imitated to good advantage by some, at least, of our American machinery dealers.

Not only are the machines shown in operation, but the aim has been in fitting up this show-room to have it represent as nearly as possible the works of the concern mentioned. The same arrangement is used for attaching countershafts to the ceiling and the same tool stands and various fixtures and conveniences that are used in the Berlin works are to be found here. The object, of course, is to make the place attractive to engineers and those interested in planning works or in refitting shops.

It is worthy of note also that in this show-room the effort is made to specialize in much the same way as is done in the shops. One floor is used purely for a machine show-room. The next deals entirely with small tools and the offices. The other floors of the building, of which there are six altogether, give ample room for boxing, packing and storing.

In this connection it may be of interest to glance at the engraving, Fig. 2, which is from a photograph made in the works of Ldw. Loewe & Co., Berlin, last July, on the occasion of the visit of the English and American engineers to Berlin, when they were entertained by the company



GROUP OF VISITING ENGINEERS AT WORKS OF LDW. LOEWE & CO., BERLIN, LAST JULY.

named. This picture gives a view down through the main machine hall of the works. We do not recognize all the men, but the third man, counting from left to right, is Jesse M. Smith; the fifth, Mr. Bartlett; the sixth, Prof. Reuleaux, and the last, Mr. Loewe himself. The various groups of visitors were all photographed at this point in the works and we have thought this one at least worthy of reproduction. It gives an excellent picture of Prof. Reuleaux, and at least a fairly good one of Mr. Loewe.

Echoes from the Oil Country.

OIL-WELL MECHANICS.

Several years ago someone gave a description, in the "American Machinist," of a method he believed good for doing a certain kind of work. The way was evidently very different from the ordinary, as I recollect that it was criticised very freely, and, judging by the writings, the objections came from men of ability and experience in their own lines, much more so indeed, apparently, than the first writer.

After some time the first writer sent in a communication, from which I gathered about these ideas: He was pretty thoroughly convinced, after reading the various objections, that his way was contrary to all mechanical knowledge; that it was an extremely poor way, and, really, only one thing kept him from thinking it would not work at all, and that was the fact that he had made many thousands of pieces that way, and ma'e money at it, although doing them piece work and getting prices lower than paid those doing them by the other methods.

While I do not remember the job or the writer's name, the mechanical lesson it carried has often been of great service. The idea has come to my mind very often when looking at oil-country rigs and ways. I have stood on an oil derrick floor and looked over the crude contrivances, considered their cost, watched the work being done, and tried to think of any change for the better that I could make.

Try to design a machine for drilling a hole a thousand feet deep; make it strong enough to stand the jerk of a ton of iron and steel on the end of a cable; have it so "universal" that every operation can be

done with the least loss of time, compact enough so that everything will be within easy reach; provide means so that two men can be engineer and fireman, blacksmith and helper, and still keep the drill going continuously, so that they can handle the heavy weights without undue effort, and get down 1,000 feet of hole in ten days (it has been done in six), with casing all in. Make this machine so that three men can build it in five days. After you have your design made, come and look at an oil-country rig.

The derrick is 72 feet high, big at the bottom and small at the top, not a board in it that can be spared, as you will admit as you hear it creak and see it weave around under the work, yet so strong that it doesn't break down. A pulley lashed to the floor makes a fine device to change the motion for that old piece of line that blows the bellows, getting its motion from the walking beam. The sticks with notches serve to hold the bit (drill) at just the right angles so that the blacksmith (tool dresser) does his own helping. With just enough water in the shallow trough setting the finished bit on end gives the proper temper without more trouble, although this is sometimes varied. Just why a forked stick is always used as a throw-off for the bull rope may not be clear, yet I have never seen anything else used.

The judgment and skill used in "spudding in" the first big hole that takes the conductor pipe which holds back the surface earth, must be continued through all the operations of drilling, sand pumping, casing and so forth, and must be exercised on the jump, as no time can be spent standing still if time is to be made, and every crew want to be able to put a broom on the top of their derrick and hate to see it on another's. The broom is used as a signal to signify that that well claims to have made the best time for the depth drilled in that district, and its being put up calls forth much discussion among those interested.

While the drilling calls for great judgment and skill it is still below that needed in a fishing job. All sorts of things happen to wells. The tools unscrew at some of the joints and have to be fished out. This is simple, and a horn socket made of steel and shaped like a big fish-horn is run down over the piece, driven on solidly, and the piece is picked up by friction hold.

Perhaps if a man lets a bit drop from the top of the hole, it is apt to stick very tight at the bottom; then some kind of socket with teeth has to be used to take a firm hold. Of these there are many varieties, named according to the piece they are intended to grasp or the way they work.

It may be that a pin has broken off close, leaving a shoulder that loosely fills the hole, so there is no room to get around it for a hold; then a hollow mill must be run and a pin milled on to get a hold of. Think of using a mill several hundred feet away from you.

One of the fishing jobs that makes the meanest kind of work is fishing for rope, either sand line or cable. Should the boiler or sand pump get stuck, and it looks as though the line would break before bringing it, many drillers will run a knife down and cut the line close to the bottom and then go after the piece with the cable.

All wells are not cased to the same depth. This casing is intended to keep out water and support any loose formation. It sometimes happens that in drilling below the casing a cave-in will catch above the tools, or a crevice will be struck in the rock that tends to lead the tools out of line or a boulder will fall into the hole and act as a very efficient brake. The "knight of the temper screw" has to face and meet these conditions as best he can. In extreme cases the tools are abandoned in the hole, the hole is plugged and the well is given up. In others a hole will be worked down alongside of the tools until it is in below them, when a small shot of nitro-glycerine is put in. This is looked on as a last resort, as, if it does not bring the tools, it spoils the well and puts the tools in such shape that nothing else will. Through all the processes and operations the judgment of the mechanic stand forth. How fast to run, how much stroke to give, how hard to hit, how much water to use in the hole, all influence the result.

The drilling is done with a blow. The motion of the walking beam to which the cable is attached, can be a few inches or several feet, and the speed fast or slow as the driller sees fit. The spring or stretch of the cable is an important factor. Some rock may be found so hard that inches of progress are measured by hours of time. At the end of it all is the uncertainty. Will it be a gusher and mean a fat bank account, a good pumper that will pay well for the expense, a measly little thing too poor to do anything with, yet just a little too good to throw away, or will it be a dry hole? In any case, a shot of nitro-glycerine will be tried and things either made better or worse, you don't always know which. Should the well be a pumper it will be tubed with a pump barrel at the bottom of the tubing and be connected with more of its fellows by some very simple and effective rigging to be operated with little cost.

Two men are all that work on a well at once. The driller is head man and expert, while the tool dresser fires the boiler, keeps the engine in shape, dresses the bits and is general assistant in all work needing both. They work together like trained soldiers. The crews run tour (tower) from midnight to midnight. Sometimes a careless tool-dresser blows up the boiler, or a poor driller "blows up" the sand reel or bull wheel (they go to pieces from being run too fast) or the engine "blows up" from too much water in the boiler, while a violent windstorm generally blows down a good many derricks. That seems to be where they are weakest.

W. Osborne.

Spacing for Prime Numbers of Gear Teeth on the Universal Milling Machine.

BY WM. PILTON.

"I read the article by Mr. De Leeuw in last week's "American Machinist" (No. 49) on spacing for the prime members of gear teeth. Here is another way and one that can be put into practice on the regular spacing heads now in use. If you will come over to the milling machine I will explain it to you."—Ben Noble.

Mr. Noble's explanation was of interest to me and will posibly interest others. I therefore offer the following explanation with the sketch accompanying it.

The spur gears *A, B, C*—*A* being the idler—in their connection with the miter gears and worm and worm-wheel are as found on the spacing head when arranged for cutting spirals in taps, hobs, spiral gears, etc., a rotary motion being imparted to the work, in adition to and without interfering with the usual spacing.

Now removing the idler gear *A* and engaging even gears at *B, B B*, it follows that when turning the index lever the spindle will rotate the index plate in a ratio of 1 to 1, and according to its direction one tooth will be added to or deducted from the regular spacing. In other words, with this arrangement we index on a moving plate instead of a stationary one, and, the sector being adjusted to span a given number of holes in the plate, the actual movement of the blank in spacing is that due to the number of holes spanned plus or minus the movement of the plate, according as the plate turns with or against the spacing lever. To deduct one tooth, the plate must move in the same direction as the spacing lever, and to add a tooth, in the opposite direction.

For instance, to cut 59 teeth we first select the index circle and adjust the sector for spacing 60. Now, starting with the spacing lever in the vertical position, we reason that the advance of the plate at each spacing carries the hole for the pin partly around and thus advances the pin that much beyond the position given by a stationary plate, the result being that the complete revolution of the blank will be made in 59 spacings instead of 60.

To cut 61 teeth, we arrange for spacing 60 as before, but use smaller equal gears at *B* and *B B* and connect them together with the idler *A*, thus changing the direction of motion of the index plate. As this now moves in the opposite direction to the pin, the movement of the index pin and blank is retarded instead of advanced, and 61 spacings are necessary to complete the turn of the blank.

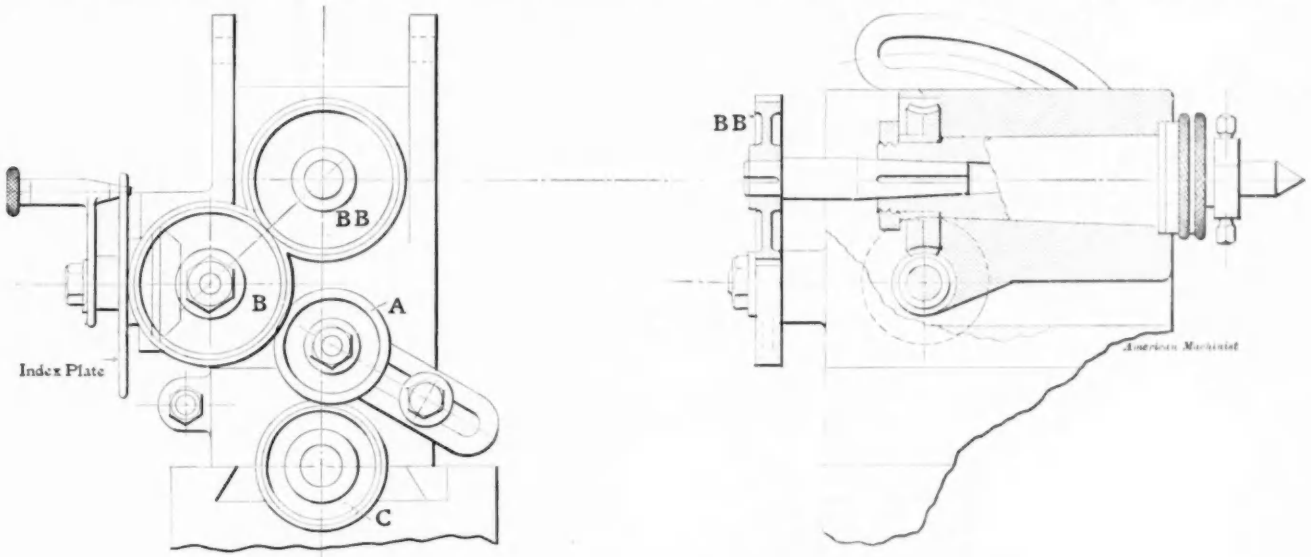
The further application of this will read-

ily suggest itself to the other methods of spacing as on the regular gear-cutting machines, though not so conveniently as in this illustration.

Hamilton, Ohio.

[This impresses us as a very valuable contribution to milling-machine methods and one which has a much wider application than is here outlined. By using unequal gears for *B* and *B B* the range of the differential movement is greatly extended. By having two pairs of such gears with a ratio of 2 to 1—two pairs in order to permit their being geared direct or through an idler—two teeth could be added or subtracted from any number which can be reached by the regular methods, and when the number to be indexed is above 100, the addition or subtraction of 2 is frequently necessary to reach certain numbers. Consulting the Brown & Sharpe index table shows that gears for adding and subtracting one and two teeth will enable every number to be indexed up to 222, except only 175, 176 and 177.

Gears having a ratio other than unity can obviously be used in either direction. Thus 2 to 1 gears can be used as supposed above to give two turns to the plate for each turn of the blank, or, reversed, they would give one-half a turn, and applied thus the 177 gear could be cut. To do this, we would set for $\frac{177-1}{2} = 88$. The result of such a combination would be to give one-half an added tooth for each turn of the blank, and by manipulating the index pin as though spacing the blank for 88, each alternate tooth would be cut, the gear being completed by going twice around it. Similarly the 175 gear could be cut by setting for $\frac{175+1}{2} = 88$, using the idler and going twice around. It is obvious also that by compounding the idler an almost limitless number of combinations can be made. It should be noted that going twice around in this manner will consume no more time than to cut the gear by going once around.—Ed.]



SPACING FOR PRIME NUMBERS OF TEETH IN UNIVERSAL MILLING MACHINES.

Power and Light for the Machine Shop and Foundry.*

BY FORREST R. JONES.

The writer has recently had occasion to investigate the plants of two concerns with regard to electric power transmission and light. In one of these, the floor space over which light and power are required is about 7 acres; in the other, about 4 acres. The arrangement of the floor space is radically different in the two cases. In the first, there are several buildings entirely separate and at some distance from each other, and the floor space is nearly all upon the first floor, there being a small amount upon the second floor, and next to nothing on the third floor. In the second, the floor space is nearly all in an L-shaped building, partly of four stories and partly of three, and, in addition to this, a small two-story structure setting close to the other building within the inner angle of the L.

The output of each establishment is in a way similar, both producing iron machinery chiefly. In the smaller establishment, the product is much lighter in weight than in the larger. The operating machinery in the two plants is quite similar, the lighter machinery is about the same in each, but the larger has a considerable amount of heavy machinery which has no counterpart in the smaller. Both plants were examined to see what requirements would have to be fulfilled by an electric system, or systems, for power transmission and lighting. The first examination was made with a view to determining whether one or more kinds of current (of the direct, single-phase alternating, or polyphase class) would be desirable. In both cases the same conclusion was reached, namely, that the most feasible way to meet all requirements would be to adopt either one or more systems of electric circuits, the current to be of the same kind in each system if more than one were used, such that any electrical apparatus to be used in the plant, when placed in the location fixed for it, could be individually and conveniently attached to the electric circuit at a near point and operated by current therefrom in a manner suitable to the requirements of the service the apparatus was designed to perform and the limitations of the service for the particular locality, the latter to allow for taking into account the fact that, at some places, a motor must run with a speed varying but slightly from uniformity, while at other places, and for other services, considerable variation of speed might not be objectionable; also, that while the electric light might, in some places, be required to operate with a uniform brilliancy and absence of fluctuation, as in an office or drafting room, there might be other places to illuminate, such as the foundry, casting-cleaning room, or an emery wheel, where a very considerable variation in its brilliancy would not impair its usefulness.

The selection of a single system from which all apparatus might be operated was based upon the conviction that, for machine-shop and factory purposes, it is exceedingly desirable to be able to interchange similar apparatus and to place any piece of apparatus anywhere upon the system, thus obtaining the maximum flexibility and greatest facility for operating portable machine tools at any point, and also to allow for alterations and extensions of the works. The study of the requirements

*Presented at the New York meeting, December, 1900, of the American Society of Mechanical Engineers, slightly abridged.

of every form of apparatus that might be brought into use and demand current from the system was naturally necessary in order to decide whether direct current, single-phase alternating, or polyphase, should be used.

The oldest of machine tools, the lathe, was taken up first, and since in both establishments it was deemed advisable to have some lathes driven individually by variable speed motors, and that the variation of speed should cover, by small steps, a considerable range, the only thing that seemed satisfactory for this purpose in the present state of speed regulation for different types of electric machinery was the direct current. And, in order that the range of speed variation might be as great as possible, the multiple voltage system appeared to be advisable, even though the speed regulations were to be made, for a given supply circuit voltage, by rheostatic control of the current in the magnet coils of the motor.

Other machines of a nature in a way similar to the lathe, so far as their driving is concerned, among which may be included the boring mill, drill press, shaper, slotter, gear cutter, and screw machine, can be operated satisfactorily under conditions of speed variation similar to those which answer for the lathe.

The planer, whose reciprocating motion requires the reversal of nearly every part of its machinery, presents a problem which is not yet satisfactorily solved for electric driving by a direct-connected motor. The nearest solution that has been reached is to drive its countershaft in one direction continuously, just as it might be driven from a line shaft, and effect the reversals of the machine in the ordinary method common to mechanical driving. The ability to secure different cutting with maximum return speeds for machines of this type is unquestionably desirable when working upon different kinds of materials, or for taking heavy and light cuts. Different speeds can be obtained readily with many types of direct-current motors by rheostatic control of the field magnet current, and, therefore, this feature needs no further attention than already given the lathe.

Nearly all electric hoists and cranes are now operated by constant-pressure, direct-current motors. They seem to be at least as satisfactory as those driven by any other type of current.

Constant-potential, direct-current arc lamps have long shown themselves efficient, durable, and otherwise satisfactory. They can be operated individually and economically at any pressure between 100 and 125 volts, even though the pressure fluctuates considerably. (It is not intended that these are the limiting pressures of satisfactory service.) The lamp is, of course, more economical at its rated pressure without any of its rheostatic resistance in circuit. Incandescent lamps have long been operated at from 100 to 110 volts with perfect satisfaction.

Motors for electric cranes and for general power purposes about the machine shop can be operated satisfactorily at any of the ordinary pressures for running motors, but it was not thought advisable, especially in connection with the conditions to be met in operating other apparatus, to give them a pressure greater than from 220 to 250 volts. The higher the voltage, within practical limits, the greater the economy of wire in the electrical circuit, of course. But, even leaving the requirements for other apparatus out of consideration, voltage as high as 500 is not desirable for the machine shop and foundry, for there is always a considerable degree of probability that employees will receive shocks by coming in contact with the wires or machinery. The writer's experience has given him sufficient respect for a 500-volt circuit to make him wish to keep others away from it.

On the whole, it was, therefore, concluded that 220 volts for the majority of motors, and 110 volts for arc and incandescent lamps, would be the most suitable. These voltages can be obtained, as is well known, by the three-wire system which has been so long in use.

In order to obtain information as to the amount of power required for driving different parts of the plant, numerous tests were made upon individual machines, groups of machines, sections of line shafting, cranes and elevators. Although so much data have already been published showing the power required to drive machine tools for iron working and wood working, it is believed that there are some points of sufficient value among that obtained in these tests to entitle them to attention. The data given below are of a nature not generally found in the reports that have been made upon electric driving, but present some rather unusual cases.

The power required to drive a couple of lathes, one of 48-inch and the other 36-inch swing, was taken when both were polishing hollow cylindrical columns, one 10 inches in diameter and the other 12 inches. In both cases the polishing laps gripped the work so tightly as to keep the driving belt of each lathe on the point of slipping. The speed was as high as could be safely used for machines of this size. To drive the two lathes together under these conditions, something over seven mechanical horse-power, delivered by the motor to the belt running from its pulley was required. It can be seen that this is considerably more than is required for a lathe performing any of the operations common to machine construction in the ordinary shop. It may not equal the amount of power necessary for taking heavy cuts upon large steel shafts, heavy gun tubes and jackets, etc. It does represent the power, however, which must be used as a basis to determine the size of a motor to drive a lathe which must do such work as demanded for these two. If a number of lathes for this class of work are to be grouped together, and there is a possibility, which is very probable, that several of them may have polishing under way at the same time, and therefore demand a maximum amount of power, the motor for driving them as a group must naturally have a capacity equal to the combined maximum demands of all of them, due allowance being made for its ability to stand overloading for a short period of time.

Although it is well known that the power required to drive a metal-working planer is generally greater on the return stroke than on the forward, or cutting stroke, and that, at the time of reversal, the power demanded is greater than at any other time, the following data may not be out of place.

Two planers, one with 22-foot table and 120 inches between housings, and the other with 25-foot table and 72 inches between housings, were both driven by one motor belted to a jackshaft, which in turn drove the two countershafts of the planers. The following data were obtained:

120-INCH PLANER WITH 22-FOOT TABLE AND 72-INCH PLANER WITH 25-FOOT TABLE.

Both machines driven by one motor. Jackshaft running in all cases.

	Amperes.	
230 Volts.	20	One countershaft.
	60	Average for 120″ planer on cutting stroke, light cut, and one countershaft.
	55	120″ planer reversing from return to cutting stroke.
	110	120″ planer reversing from cutting to return stroke.
	27	Both countershafts.
	240 to 250	Both planers reversing from cutting to return stroke.

Both machines were working upon rather heavy castings and taking comparatively light cuts at short strokes over bosses and parts of the castings where other members of the machines were to be attached. The power, therefore, is approximately that which would be required to drive the machines without taking any cut, but carrying loads upon their tables. It may be noticed that the amount of power for reversing the 120-inch planer was about 1.8 times that for its average running at time when not reversing. When it happened that both machines reversed at the same time from the forward, or cutting, to the back, or return, stroke, the power required ran up to a very great amount, more than 60 mechanical horse-power. This amount of power was not indicated by the instantaneous extreme

throw of the ammeter needle, but was the reading at which the ammeter stood steadily for some seconds, a period long enough to make the demand distinctly felt by the engine and generator.

A planer with a 24-foot table and 60 inches between housings showed the following amount of power required:

60-INCH PLANER WITH 24-FOOT TABLE.

	Amperes.	
230 Volts.	7	Shafting only.
	8–9	Forward stroke without cut.
	10–15	Light portion of cut on rough casting, $\frac{1}{4}$ inch feed.
	15–20	One tool cutting cast iron $\frac{3}{16}$ inch deep × $\frac{1}{8}$ inch feed.
	20–25	One tool cutting cast iron $\frac{1}{4}$ inch deep × $\frac{1}{8}$ inch feed.
	20–25	Cutting $1\frac{1}{16}$ inch groove in cast iron with square nose tool; feed between $\frac{1}{32}$ inch and $\frac{3}{64}$ inch; groove not cored.
	35	Reversing and return to cutting stroke.
	45	Reversing from cutting to return stroke.

It may be noticed that the power required for reversing this machine, especially from the cutting to the higher speed return stroke, is nearly double that for the forward stroke when cutting.

A planer with a 40-foot table and 74 inches between housings gave the following data. The great power required for reversing from the cutting to the return stroke again stands out:

74-INCH PLANER WITH 40-FOOT TABLE.

Cutting speed, 20 feet per minute; two tools operating on cast iron; cut on each, ½ inch deep, ⅛ inch feed.

	Amperes.	
Volts. 234	22	Countershafting only.
	50	Considerable portion of the time while cutting.
	60	For some moments while cutting.
	35	Middle of return stroke.
	90	Reversing from return to cutting stroke.
	120	Reversing from cutting to return stroke.

Of the twenty-odd traveling cranes in one establishment, ten were tested for the power required to drive them. Of these ten, some were driven electrically and some mechanically. The majority of the electrical cranes were of the ordinary types designed for electric driving. One was a remodeled crane which had originally been driven mechanically by a square shaft running alongside the building parallel to the track. Some of the mechanically driven cranes were furnished power by a square shaft alongside the building and parallel to the track, and others by a flying rope running alongside the track. Obviously, in providing for the power to drive a crane it is necessary to know the maximum amount of power that it may demand for a period of time great enough to make the demand appreciably felt by the generating plant. In this respect the following data, obtained from three electric traveling cranes of 30 tons capacity each, all traversing the same track above the foundry floor, show how great may be the demand, for an appreciable period of time, by some one of the cranes, and, with perfect possibility, by all of them at the same instant.

Each of the 30-ton cranes was equipped with four motors—25 horse-power for bridge travel, 8 horse-power for trolley travel, 25 horse-power for the main hoist and 16 horse-power for the auxiliary hoist.

It can be seen, by examining the data obtained from these 30-ton cranes, that when all the motions on one were in operation simultaneously, and when two or more of the movements were started at about the same instant, the demand made for power during this general maneuvering was very great indeed. The readings given for such general maneuvering for two of the cranes when carrying a load of 20 tons each, the reading running as high as 320 amperes in one case and 310 in the other, represent demands for current during periods of from five to ten seconds' duration, as shown by the steady reading of the needle of a dead beat ammeter. It not infrequently happens that such a condition comes about in everyday practice. That two or more of these cranes did, when in regular service, make very heavy demands for current at the same instant, was clearly shown by watching the ammeter at the switchboard of the generator supplying current to the three cranes only. Although this generator had sufficient capacity to operate several 30-ton cranes under what might be called average load, and the magnetic circuit breaker for the generator was set considerably above the steady-load capacity of the generator, it was not an unfrequent occurrence for the circuit breaker to open up the circuit on account of the great momentary demands made for power by the cranes.

Tests upon a 15-ton electric crane, two 5-ton electric cranes, a 15-ton flying-rope crane, a 15-ton square-shaft crane and a 15-ton square shaft crane remodeled to be driven direct by an electric motor, all showed similar heavy momentary demands for current under general maneuvering.

A somewhat surprising condition was found in one of the elevators, which, during the regular operation of the shop, was driven mechanically from the line shaft by means of a worm and worm-wheel connected to a winding-drum for the elevator cable. The elevator was of comparatively small capacity, and should not ordinarily require probably more than 5 horse-power to drive it. But, apparently on account of some fault of the worm and worm-wheel mechanism, the very excessive amounts of power shown in the data given for this elevator were sometimes required.

The worm and wheel mechanism appeared to be in proper condition, however, as far as could be seen by outside inspection. It was well lubricated by a bath of oil and flake graphite, in which the worm ran. Here seems to be a lesson in the use of the worm and worm-wheel mechanism setting forth the fact that care should be taken in its adjustment, and to see that the rubbing surfaces of the worm and wheel are kept in proper condition.

30-TON ELECTRIC TRAVELING CRANE NO. 1.

	Amperes.	
Pressure, 240 volts when crane was taking no current.	125	Bridge starting, no load.
	50	Bridge traveling uniformly, 350 feet per minute, no load.
	33 to 40	Lowering, no load.
	105	Starting to hoist, no load.
	36	Hoisting uniformly, no load.
	145	Bridge starting, 20-ton load.
	50	Bridge moving uniformly, 240 feet per minute, 20-ton load.
	95	Hoisting 20 tons uniformly at 10 feet per minute.
	310, 200, 150	General maneuvering, 20-ton load.

30-TON ELECTRIC TRAVELING CRANE NO. 2.

	Amperes.	
240 Volts.	110	Bridge starting, no load.
	65	Bridge traveling uniformly, 450 feet per minute, no load.
	15	Trolley starting, no load.
	13	Trolley moving uniformly, no load.
	36 to 50	Lowering, no load.
	130 to 150	General maneuvering, no load.
	90	Bridge starting, 20-ton load.
	50	Bridge traveling uniformly, 20-ton load.
	145	Hoisting, rapid start, 20-ton load.
	115	Starting to hoist, reading for 3 seconds, 20-ton load.
	95	Hoisting 20 tons uniformly at 10 feet per minute.
	260	Bridge and trolley starting, reading for a few seconds, 20-ton load.

30-TON ELECTRIC TRAVELING CRANE NO. 3.

	Amperes.	
240 Volts.	90	Bridge starting, no load.
	50	Bridge traveling uniformly, 535 feet per minute, no load.
	38	Lowering uniformly, no load.
	40 to 45	Hoisting uniformly, no load.
	150	Bridge and trolley starting, 20-ton load.
	30	Trolley at uniform speed, 20-ton load.
	34	Hoisting uniformly at 11 feet per minute, 20-ton load.
	240	Bridge and trolley maneuvering, reading for 2 seconds, 20-ton load.
	320	General maneuvering, 20-ton load.
	250	
	200	
	230	
	180	

ELEVATOR OPERATED BY WORM AND WORM-WHEEL.

Mechanical Horse-powers.		
Going Up.	Coming Down.	
19.2	10.4	No load.
16.5 to 21.8	....	No load.
....	.1	After running some time.
2.5	....	One man on.
....	.1	Countershafting only.
7.8	....	2-ton load, estimated.
7.3	....	2-ton load, estimated.

When well oiled 15 amperes were at one time required to lower the cage without load: but for the following trip, immediately after, 60 amperes were required to lower without load. The next trip down only took 15 amperes. The same variation of power occurred throughout the test.

Two fans, used in connection with steam coils and hot-air pipes for heating buildings, took the following amounts of power to drive them. They were both of the radial-blade, fan-wheel type (the blades arranged as on the paddles of a side-wheel steamboat). The casing of the larger measured 108 inches in diameter by 60 inches wide, the latter measurement taken parallel to the fan shaft. There were two tangential discharge openings in the case—one at the top, 24 by 60 inches, and another at the bottom, 54 by 28 inches; the larger dimensions in both openings were parallel to the fan shaft. The rotating part of the smaller fan measured 60 inches in diameter by 28 inches wide. It had a single outlet, 29 by 31 inches. Each fan had been installed by its manufacturer in connection with the other parts of the heating system. The larger one was not brought up to its rated speed because the power required to drive it was much more than anticipated when a motor of 20 horse-power capacity was belted to it. The slipping of the belt was the real limiting cause for not applying more power with the 20 horse-power motor. There was not time to substitute a larger motor or another belt.

108x60-INCH FAN FOR HEATING.

Mechanical Horse-powers.	Revolutions per Minute.
20.6	160
23.6	180

60x28-INCH FAN FOR HEATING.

Mechanical Horse-powers.	Revolutions per Minute.
.8	120
1.2	176
4.8	275
11.4	360
12.5	370

That more complete data might have been taken in the above tests is fully realized by the writer, but at the time of obtaining them there was no thought of making them public. The work was done only to obtain an idea of the power required to drive, so that the size of motor might be specified.

By examination of the data given above, it may be seen that the constantly recurring and great momentary demands for power made by cranes and hoists would necessarily affect the pressure in the wires carrying current to them from the switchboard in the power-house. Hence the circuit feeding the crane and elevator motors would not be suitable for also furnishing current to motors which require to be run at even a fairly constant speed, or even hardly for incandescent lights in places where a steady illumination is not essential. It would be difficult to find constant voltage arc lights that would operate with even a fair degree of satisfaction at the points of greatest variation of pressure in the circuit. It therefore becomes necessary to have what might be called a "crane circuit" for at least the majority of the larger cranes in an establishment of the proportions of those mentioned earlier in this paper.

The incandescent lights for use in offices, drafting rooms, and possibly some parts of the shop itself, as the toolroom, and where the small and more accurate parts are manufactured, must have a pressure in the circuit leading to them which, at least, does not fluctuate rapidly, even though it may be allowable for it to vary slowly to a slight extent. A "lighting circuit," primarily intended for incandescent lighting, therefore, also becomes a necessity.

Such machinery as lathes, drill presses, shapers, milling machines, slotters and gear cutters do not ordinarily need to be driven at a speed that is even very uniform. Variation of speed on each side of the normal is allowable to a considerable extent in many cases, provided the variation is not a jerky one, such as often comes on line shafting used to drive heavy planers. A third circuit, primarily intended for driving machinery of this class, needs to be installed. This may be conveniently referred to as a "machine-tool circuit."

Whether an iron-working planer may be placed upon the machine-tool circuit depends largely upon the size of the planer. The heavier machines, on account of the great momentary demands they frequently make for power, would be apt to produce sudden and considerable variations of pressure in the machine-tool circuit. Better general operation of the entire plant can be obtained by placing them on the crane circuit. The smaller planers can safely be placed upon the machine-tool circuit, thus obtaining more uniform motor speed for driving them, while not materially affecting the pressure in the latter circuit.

The pressure on the machine-tool circuit would remain constant enough to operate constant-pressure arc lamps with perfect satisfaction. Such lamps, therefore, may be placed anywhere upon either the machine-tool circuit or the lighting circuit, and possibly upon some parts of the crane circuit where the fluctuation of pressure is a minimum for that circuit. Incandescent lights can of course be placed upon any of the circuits. The pressure in the machine-tool circuit should be sufficiently constant to insure a brilliancy uniform enough for many places in which an incandescent lamp is put.

Certain classes of machine tools, such as the emery grinder for finishing-reamers, mandrels and accurately formed machine parts require a very constant speed for the production of well-made pieces. A jerky speed, as of a line shaft forming part of a system on which are heavy metal-working planers, causes the grinding wheel to cut deeply into the work in some places, thus making a well-finished product impossible. Power for light machines of this type may be taken from the lighting circuit without detriment to its constant pressure. Desk fans, and even larger ones, can also be connected to the lighting circuit without harm.

On account of the great variation in the amount of power demanded by cranes and other classes of machinery already mentioned, it was doubted whether all the circuits leading out through the works could be connected to the same bus bars in the power-house without causing a fluctuation of pressure great enough at the bus bars to affect appreciably the constant brilliancy of the incandescent lamps placed in locations where the most steady light would be required. Just what would be

the effect could not be predetermined. For this reason it was decided that the switchboard should be so made, and the generating machinery so divided into units, that, if the amount of fluctuation caused in the incandescent lights should be too great when feeding all circuits from the same bus bars, the crane and heavy planer circuit could be thrown on to one generator, and the other machinery and lights fed by another generator. If, as was hardly supposed would be the case even with this arrangement, the incandescent lamps should not burn steadily enough, there would still remain the expedient of a separate generating unit for the lighting circuit. The supposition was that, even though such a separate lighting unit might be necessary at the times when the cranes would be performing their heaviest duty, which is while running off a heat in the foundry, there might be other considerable periods of time when the demands by the cranes would not be sufficient to affect the lights appreciably, even though all were operated from the same bus bars. Such being the case, the lighting unit would have to be operated a small part of the time.

It seems advisable to install at least two generating units exactly alike, and to have one small unit which might be used for furnishing the current to run one or two machine tools, or even a small electric hoist or elevator, when there might be a demand for such service on account of making repairs, or operating some one or two machines on holidays, or in case of a breakdown, such a unit to be driven independently of the main power plant, so that, even though the fires might be dead under the boilers, this extra unit could be operated. A unit consisting of a small generator driven by a water-wheel, or by a gas or gasoline engine, would answer such a purpose. Two large suits, running in parallel, for carrying the bulk of the load, or separately for dividing it between them in case the cranes and heavy planers would have to be driven separately from the other machinery, would give a desirable division of the power units for night work and when operating only a part of the plant. This would give an opportunity for repairing the generating units without hindering the running of the entire establishment. Direct-connected units were selected as most suitable. While it is not believed that great multiplicity of generating units is desirable, it is thought certainly better to have at least two main units for the reason already stated.

A motor-generator was decided upon as the best apparatus for balancing the two sides of the three-wire circuit. In a plant where the installment of electrical machinery for power transmission goes on gradually the motor-generator may be made of an ordinary commercial motor and generator. When the demand upon them becomes too great for their capacity, they may be replaced by larger machines and used for motors in some part of the establishment. It was not thought that a storage battery would be as satisfactory for balancing the system as the motor-generator.

The question of individual driving, or group driving, of the machine tools naturally came up. The solution depended almost wholly upon the ability of arranging the tools for group driving, or the necessity for driving some individually on account of the location each should occupy in order that it might perform its special functions to the best advantage. As to what would be the most efficient limit for the smallness of motors for driving did not once come up. And the writer has been led to believe, by close examination of these two plants and the more general observations of many others, that, except for very light machinery, there is seldom any need of considering which would be the more efficient method of driving, group or individual; or what would be the smallest size of motor to be used for groups, the limit of subdivision being based upon considerations of efficient power transmission. Convenience of operation and the methods of securing the greatest amount of output from operating machinery are of so much greater moment in most cases than economy of driving in pounds of coal saved that the latter sinks into insignificance in comparison with the former. Where it is desirable to have a machine driven at a variable speed of such a nature that it can be obtained only by a corresponding variation of speed in the source of its power, then, in the general case, it is undoubtedly better to drive that machine individually by a variable speed motor, whatever the amount of power required for driving it. On the contrary, if there are a number of machines whose speed regulation can be satisfactorily secured through the ordinary mechanical connection with a uniformly rotating shaft, and if they can be grouped together and still perform their functions to the best advantage, then unquestionably the best method of driving is to use, within the limits of convenient arrangement, as large a motor as possible.

The installation of small hoists suitable for serving machine tools when the work handled is generally too large for one man to put in place, is one of the improvements in the modern machine shop which has worked much benefit and saved much time. When the work to be lifted varies in weight from 75 to 500 pounds, it is believed that the pneumatic hoist is generally best for the purpose. To be of most service it should always be available; therefore, one hoist can serve only a small number of machines at most. This being the case, there is no objection to having it attached to the feeder pipe line by a hose of only sufficient length to allow it to reach the machines lying in its field of operation. The cheapness and simplicity of the pneumatic hoist, as compared with the electric or any other form suitable for the purpose, are so strongly in its favor that it seems to have no competitor in this particular field. The air compressor for serving such a hoist is probably best electrically driven when of not too great capacity, but if the size must be large, a steam compressor forming a unit in itself seems best, it being assumed that water power is not available.

The conveying of materials and machinery from building to building and through the yards of a large establishment must needs be done, if done expeditiously, by some form of industrial railway. The form of locomotive most suitable for this purpose is not easy to decide upon. The horse hardly enters into consideration, and men are too expensive for the purpose. On account of the necessity of running through shops containing finished product and valuable machines, a steam locomotive cannot be used on account of the deleterious fumes thrown out, not to mention the fire risk. The compressed-air locomotive appears to have proved more expensive than the electric for such purpose, and the choice seems to be guided toward the latter. Current can be furnished for the electric locomotive most conveniently and economically by the overhead trolley system outside of the buildings and wherever else the trolley wires can be erected. In most places inside the buildings, however, the trolley cannot be used, so some other means must be obtained for furnishing current to the locomotive. There seem to be two methods that merit consideration, namely, by the storage battery and by the contact system of a shoe underneath the locomotive rubbing against contact points placed alongside or between the tracks. The writer is in doubt as to which would be the more suitable. The storage battery has the advantage that, with it, the locomotive can be run to any part of the track connected with the establishment, even though trolley wires have not been erected, and that it can be operated when the electrical circuits have no current in them and when the plant is otherwise shut down. The period of time during which the locomotive can be operated under these conditions is limited to the capacity of output of the storage battery, of course. The exorbitant price demanded for the storage cell makes the cost of installation heavy, and because the battery itself is liable to rapid deterioration in the hands of such persons as are generally put in charge of it in the machine shop, are points very strongly against it. The underneath contact system has been sucessfully operated for years in some plants, and new and important improvements have recently been made in it. It is believed to be, so far as its practical operation is concerned, by far the most satisfactory system that can be used inside the buildings. While not positively informed upon the cost, it is believed that the ex-

pense of installation where there is a great amount of track inside the buildings might be quite large. The electric locomotive of each of the above types could, of course, be satisfactorily operated on a 220-volt electric system.

Indicator cards were taken from the five engines furnishing power for the mechanical driving system of one of the plants. These cards were taken at the time when the load upon each engine was at the maximum value that it was found to reach during a period of half an hour to an hour. The aggregate indicated power for mechanical driving thus obtained amounted to something over 500 horse-power. Cards were taken from the same engines in order to find the power necessary to drive the line shafting, countershafts, jackshafts and all other apparatus which ordinarily ran when no operating machine or crane was at work. It was found that this frictional horse-power was considerably over one-third of the amount found by taking the maximum for each engine, as stated above, when operating the machinery. Cards taken covering a considerable period of time show that in each case the power required of the engine was much less as an average from morning till night than obtained for the maximum load. While no actual calculations were made to determine the ratio of the frictional horse-power to that for this average load, it was very clearly shown that the indicated horse-power of the engine for average load was only about twice that for friction. Each engine drove its own system independently of the other engines. Other engines were used for generating currents for the electric cranes and a few electrically driven machines and sections of line shafting.

While the results of tests upon several electric motors convinced the writer that as high a degree of economy as is often set forth for such machinery could probably not be obtained in a commercial machine built to withstand heavy loads and rough service, he was certainly convinced that a great saving of the power wasted on friction in the mechanical transmission system could be saved by electric driving. It was found that electric motors, manufactured by well-known concerns who make the best of apparatus, required, for a 10 horse-power motor, about 1 electrical horse-power to run it without load, there being no belt upon the pulley, and when the only frictional resistance to be overcome was at the journals and brushes. The latter were adjusted to bear lightly against the commutator, which was smooth and otherwise in good condition. Under the same conditions a 20 horse-power motor required about 1.5 horse-power to drive it light, and a 25 horse-power motor required at one time 1.75 horse-power, but later, after the commutator had become slightly roughened by heavy overloading, it took fully 2 horse-power to run it light. Several other motors, of sizes ranging from 7.5 horse-power to 50 horse-power, showed similar demands for power to run them light. The motors were the products of several different manufacturers. The instruments used for taking the readings of current and pressure were of the Weston portable type, and were calibrated at the Weston factory during the test.

On one motor of 20 horse-power capacity it was noticed that the speed kept gradually increasing for some time after starting, until it became 5 per cent., or more, greater than at first, although the line voltage and load remained constant, and no adjustment was made on any part of the motor or its attachments. The increase took place when the motor was completely left alone. After an hour or two the increase ceased, and the speed remained constant. The speeding up was probably due to weakening of the field magnets caused by the gradual heating of the field coils, and the reduction of field current by the increased resistance of the field circuit on account of its heating. Such an increase of speed was not noticed on other motors.

One great advantage of electric-power transmission in the machine shop is that of having a means of furnishing power to portable machine tools, either large or small, at any part of the works where suitable circuits are run. It is such a strong point in favor of electrical transmission that it deserves being ever kept before the minds of those who have to do with machine shop and factory. The time that can be saved and the greater accuracy of work that can be secured upon many kinds of large machine members, by setting them upon a machined plane-surface floor with slots and holes for inserting bolts to clamp them down, and then bringing portable machine tools to them with the crane, railway, or truck, each to perform its own special operation, makes this method of procedure worthy of consideration by the manufacturer and builder of heavy machinery. The heavy casting can be set upon a flat metallic floor almost invariably more quickly than it can be set before any machine tool occupying a fixed location, and made ready for the tool to operate upon it. If the casting requires the operations of several kinds of machine tools, it must be set again and again, as many times as there are permanently located machines required to do the work. To set a portable machine tool with a plane-machined base upon a level iron floor and bring into position for working upon a casting also upon the floor, occupies but a fraction of the time necessary for setting the casting in position for a permanent machine tool. Moreover, several portable machines may be brought into action upon one casting at the same time. This is seldom true of machines fixed in location. The writer hopes to see, and believes he will see, in no great period of time, many builders of heavy machinery doing their work in this manner. Why carry a heavy machine member about the shop to this place and that, and waste time setting it again and again before different machine tools, when many of the tools can so easily and quickly be brought to the machine part and put to work upon it?

Scales for Dividing Lines and Circles Into Parts.

BY J. E. G. YALDEN.

Many of the problems that occur to the draftsman or mechanic include the solution of the problem of dividing a line of known, or unknown length, into a number of equal or proportionate parts. Instrumental constructions for such problems have been devised, and are generally of sufficient accuracy when it is possible to apply them. From the draftsman's standpoint, some of the objections to such constructions are: Liability of error in performing the construction, time consumed in the operation, and necessity of afterwards removing the lines of the construction from the drawing. On the part of the mechanic, it is usually impossible to use such instrumental constructions on his work, owing to its size or material and the absence of instruments equivalent to those of the draftsman.

Instrumental devices, such as special scales, are generally to be preferred to instrumental or geometrical constructions in solving such problems—first, on account of their accuracy, and, second, the amount of time saved by their use. I have devised several such instruments or scales to facilitate the division of lines, the first of my universal scales having been copyrighted in 1892. An account of some of these devices, contrasted with the geometrical constructions of the problems they are intended to solve, may be of interest. Almost all of the geometrical constructions for the division of lines into a certain number of parts are applications of the principle of the similarity of triangles.

As an illustration, let it be required to divide a line AB, Fig. 1, into any number (say five) equal parts. It is assumed that it is impossible to exactly divide the line into number of parts required with an ordinary scale. In other words, its length is unknown—that is, unmeasured. The usual geometrical construction is shown in Fig. 1. Through A draw any straight line AX, on which lay off five equal parts of any length. Join C, the last point so obtained, to B, and through the other points of division of AC draw lines parallel to BC, which will divide AB into equal parts.

The geometric principle upon which this construction depends is the well-known one, that equidistant parallel lines cut equal parts from any line that intersects them.

As an illustration of an aid in solving this problem without recourse to the geometrical construction, suppose a line of

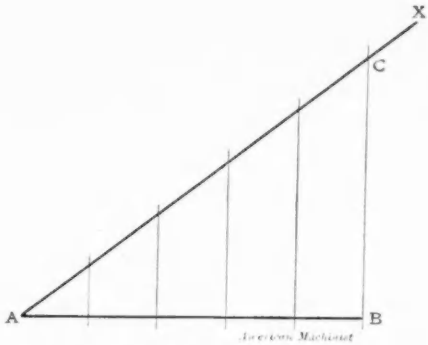


FIG. 1. DIVIDING A LINE INTO A NUMBER OF EQUAL PARTS BY GEOMETRY.

unknown length occurring somewhere on a drawing be required to be divided into seven equal parts.

Take the length of the line with the dividers and apply one leg to a point C, Fig. 2, on a piece of cross-section paper. Revolve the dividers until the other leg coincides with point D on the seventh vertical line measured from point C. The line $C D$ is then divided into seven equal parts, by the vertical lines of the cross-section paper, at points $1', 2' \ldots 7'$; and a strip of paper, with a straight edge, may be laid on $C D$ and the points marked on its edge. This strip may then be used as a scale on the drawing, from which the divisions required may be transferred in the usual manner.

A problem of everyday occurrence is the bisection of a line, and the erection of a perpendicular at the point of bisection.

The device shown in Fig. 3, which I have termed a "universal bisector," may be used to advantage in many instances. The instrument may be made of bristol board, wood, hard rubber or metal.

To bisect a line, as $A E$, and draw a perpendicular at its middle point, we have merely to place the point A on the instrument at one end of the line, and then revolve it about A, so that the arc $A E B$ of the instrument cuts the other end of the line at E. Draw a pencil or scriber along the smaller arc $A C D$, where it cuts the line $A E$, thus giving its middle point C; and mark point D at end of arc $A C D$. Remove the instrument and draw a line through C and D, which will be the perpendicular required.

The geometric principle upon which this instrument depends is as follows: All lines drawn through one end of the diameter of a circle, and terminated by the circumference of that circle, are bisected by the circumference of a circle of half that diameter, which passes through the end of the diameter of the large circle, as shown in Fig. 4, in which a line $A E$ is bisected at point C by the arc $A C D$, and a line drawn through points C and D is perpendicular to $A E$.

I have found this device particularly useful in finding the centers of arcs of circles.

All of my universal scales are based upon the following geometric principle:

If a straight line be drawn parallel to the base of a triangle and be terminated by the sides or by the sides produced, any straight line which passes through the vertex and a point of the base will divide the base and its parallel in the same ratio.

The universal scale for lines shown in Fig. 5 consists of a triangle having a base of 6 inches and an altitude of 6 inches. The base is divided into 30 parts. These parts are connected with the apex of the triangle by radial lines. Lines parallel to the base are drawn through the triangle to enable one to hold parallel to the base

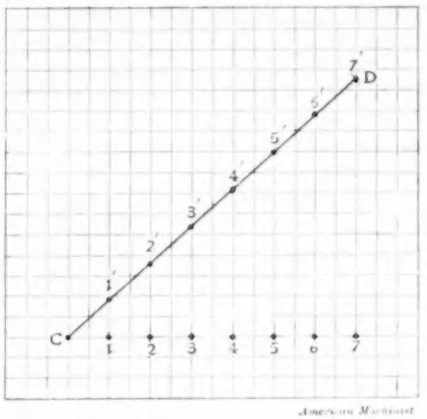


FIG. 2. DIVIDING A LINE INTO A NUMBER OF EQUAL PARTS BY THE USE OF CROSS-SECTION PAPER.

the paper on which the divisions are to be taken.

The lines marked 5, 6, 8, etc., are lines of scales on which there are 5, 6, 8, etc., parts to the inch respectively. Any such line of arbitrary parts to the inch may be found and ruled on the card.

Example: Required such a line having 10 parts to the inch. The narrow triangles have bases of 1-5 inch and an altitude of 6 inches. We require the altitude of triangles having bases of 1-10 inch. Calling this altitude x, we have from the properties of similar triangles:

$$\tfrac{1}{5} : 6 :: \tfrac{1}{10} : x,$$

from which $x = 3$.

Following are some of the applications of this scale:

To divide a line into any number of equal parts:

Mark on the edge of a strip of paper the length of the line as taken from the drawing. Let us suppose it is to be divided

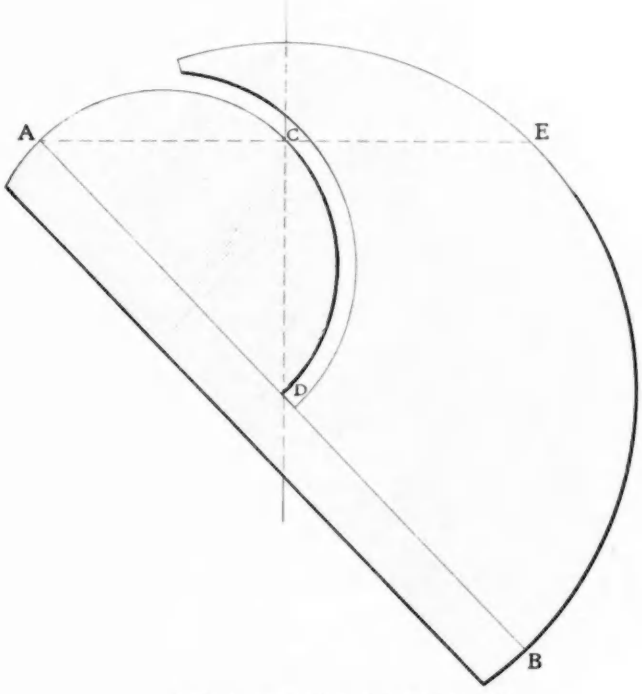


FIG. 3. UNIVERSAL BISECTOR IN USE.

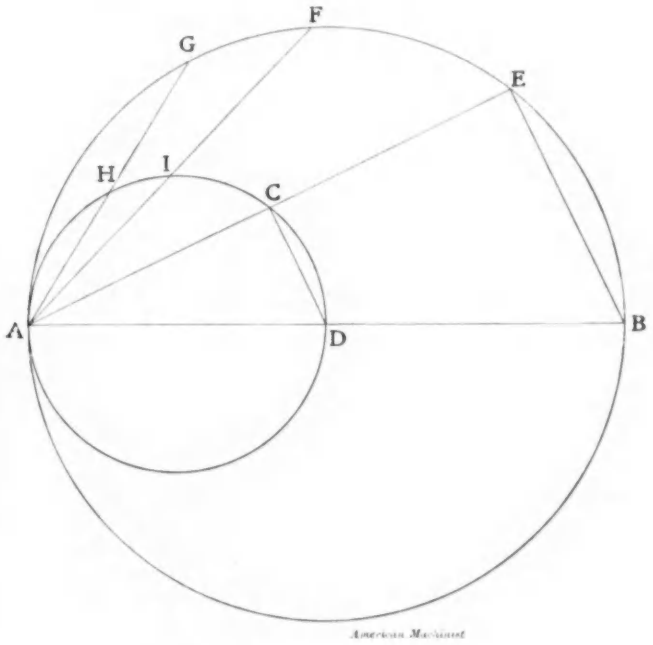


FIG. 4. PRINCIPLE OF THE UNIVERSAL BISECTOR.

into 12 parts. Fit it between the 0 and 12 radial lines on the scale by sliding it up and down till it fits, keeping the edge of the paper parallel to the base of the triangle. Mark the 12 parts, and then apply it to the drawing, using it as a scale.

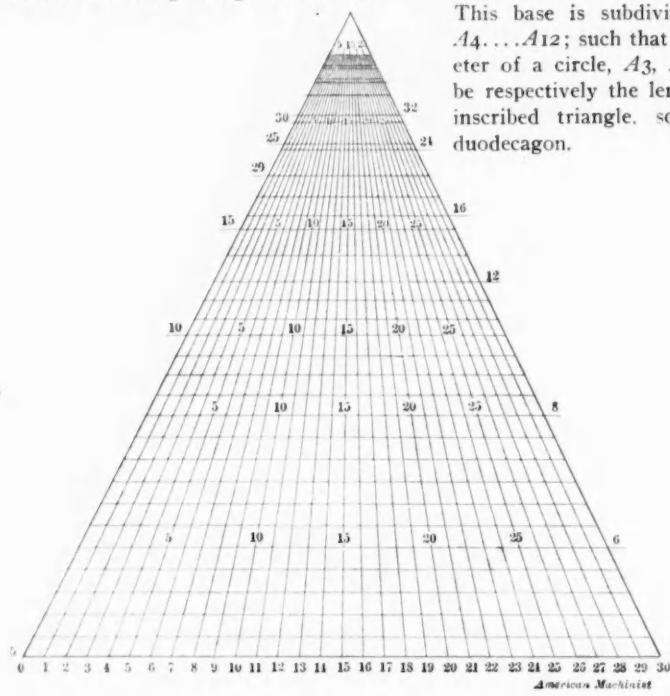


FIG. 5. UNIVERSAL SCALE OF LINES.

To divide a line into parts having a required proportion to one another:

Example: Divide a line into the proportion of 5 to 6. Take the length of the line on a strip of paper, and apply it to the scale between the 0 and 11 radial lines. Mark the point where the 5 radial line cuts the strip. The line will then be divided in the required proportion.

Among other applications may be mentioned those of constructing special scales of a certain number of parts to the inch, and of equally spacing a certain number of holes within a given distance.

The universal scale for polygons, shown in Fig. 6, consists of an equilateral triangle whose base $A\,B$ is 10 inches long. This base is subdivided into parts $A3$, $A4$....$A12$; such that if $A\,B$ be the diameter of a circle, $A3$, $A4$, $A5$....$A12$ will be respectively the length of side for the inscribed triangle, square, pentagon.... duodecagon.

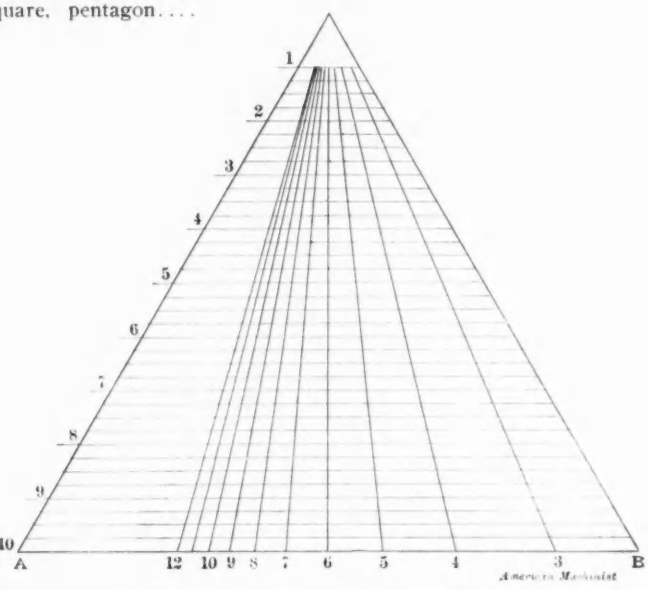


FIG. 6. UNIVERSAL SCALE FOR POLYGONS.

In using this scale to obtain the length of side of a polygon inscribed in a circle, of known or unknown diameter, we have merely to take from the drawing, on the edge of a strip of paper, the length of the diameter of the circle. Apply this strip to the scale till the points on it just meet the radial lines from A and B, always keeping the strip parallel to the base of the triangle. Mark the point where the radial line for polygon required cuts the strip, and the distance from the left-hand point to this one will be the length of side of the required polygon.

The horizontal lines marked 1, 2, 3...10 give at once the length of sides of polygons inscribed in circles 1, 2, 3....10 inches diameter.

To draw such a scale, when $A\,B = 10$ inches, make $A3 = 8.66$, $A4 = 7.07$, $A5 = 5.88$, $A6 = 5$, $A7 = 4.34$, $A8 = 3.83$, $A9 = 3.42$, $A10 = 3.09$, $A11 = 2.82$ and $A12 = 2.59$ inches.

The universal scale for finding the length, or any fractional part, of the circumference of a circle, diameter known or unknown, is shown in Fig. 7, and is an equilateral triangle, of which the base $A\,C$ is equal to the circumference of a circle whose diameter is the distance A B. The other radial lines shown cut the base $A\,C$

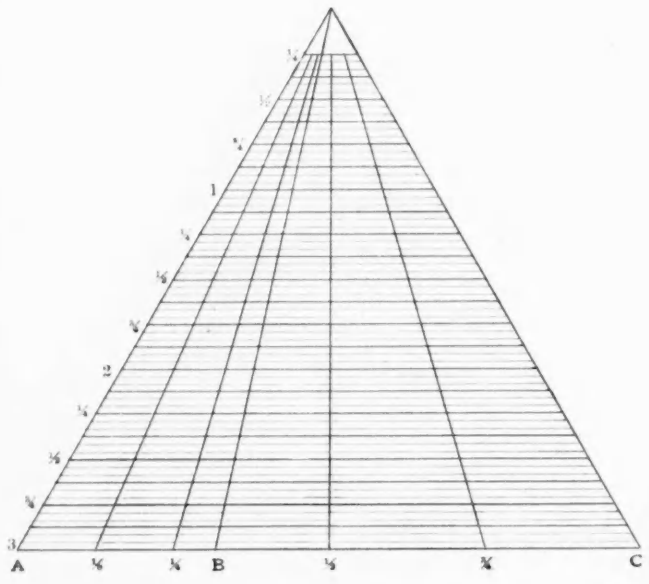


FIG. 7. UNIVERSAL SCALE FOR CIRCUMFERENCES AND ARCS OF CIRCLES.

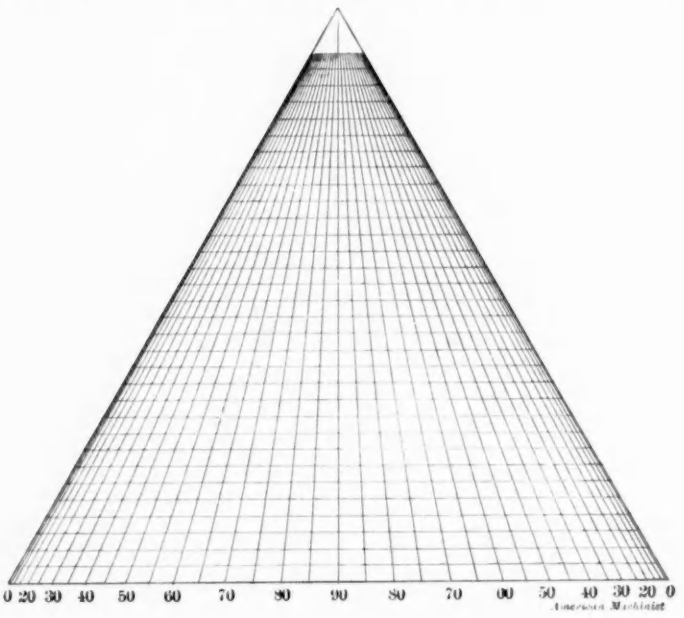


FIG. 8. UNIVERSAL SCALE FOR CIRCLE PROJECTION.

at points equal to ⅛, ¼, ½, or any desired fractional division of the circumference.

The lines drawn parallel to the base serve two purposes—those with figures attached give a graphic table of circumferences for circles whose diameters are 1, 1¼, 1½ inches, etc. In the second place, those lines serve as a guide to the eye in using the scale.

To use this scale mark off on the edge of a strip of paper the length of the diameter as taken from the article or drawing. Fit this distance between the radial lines *A* and *B*, always keeping the edge of the strip parallel to one of the horizontal lines; then mark on the strip the point where the radial line *C* strikes it, and the distance between the marks *A* and *C* will be the length of the circumference. Points marked on the strip where the other radial lines strike it will give the length of ⅛, ¼, ½ and ¾ of the circumference, or for any other fractional division of the circumference as originally laid down on the base *A C*.

The universal scale for finding the orthographic projection of the elements, or equally spaced lines on the surface of cones and cylinders, is shown in Fig. 8. This scale was designed to facilitate the operation of drawing patterns or layouts of truncated, or intersecting, cones and cylinders.

The usual procedure in such problems is to draw a plan and elevation of the article for which a pattern is required. The outline in the plan is then subdivided into a number of equal parts by geometrical construction. These points of division are then projected to the elevation to give a true orthographic projection of the elements of the object when viewed in elevation. This is a troublesome process, involving very careful drawing, and consuming a great deal of time.

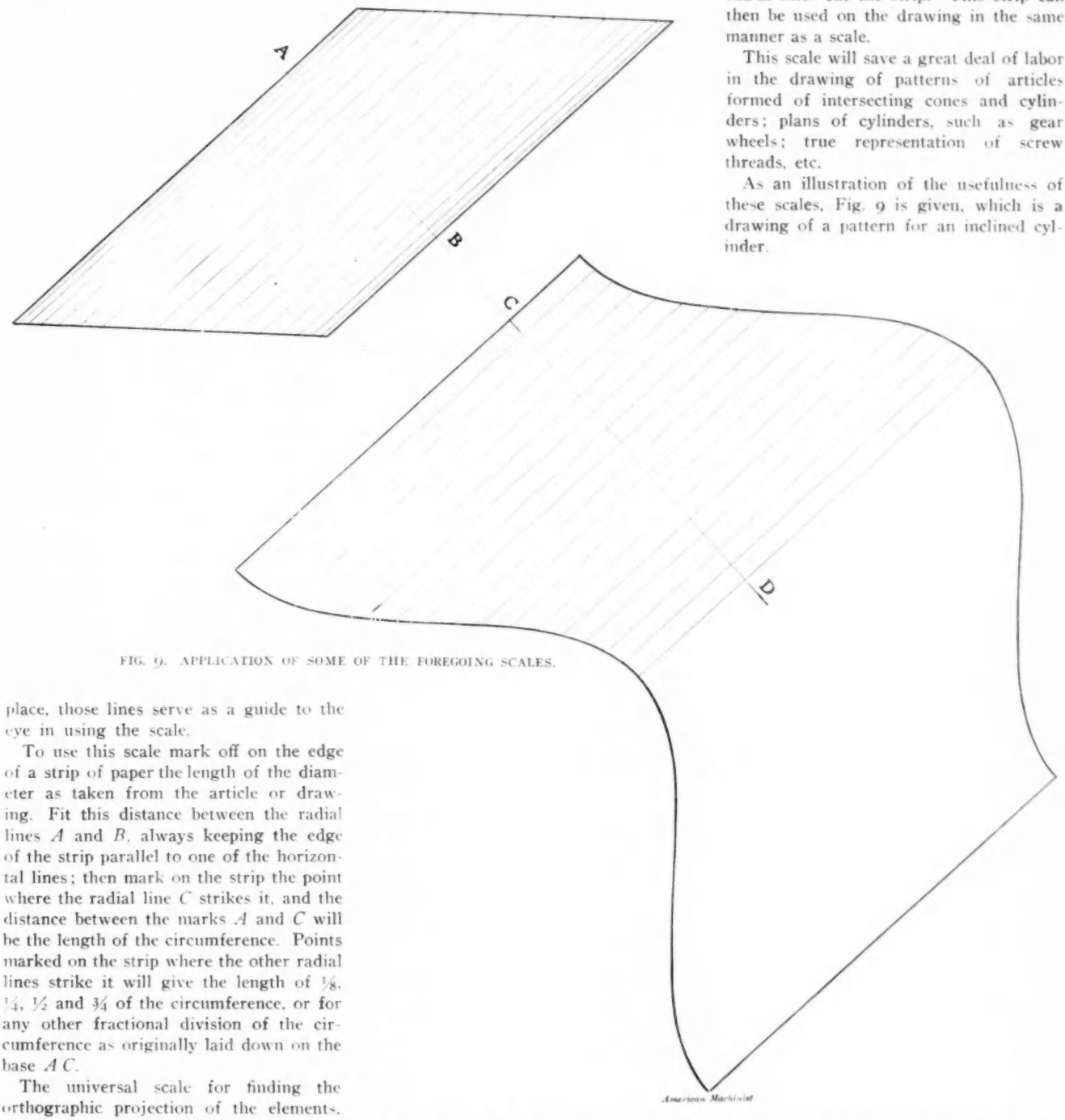


FIG. 9. APPLICATION OF SOME OF THE FOREGOING SCALES.

By the use of the above scale, this whole process is done away with; no plan is necessary or any geometrical construction to determine the position of the elements in the elevation. The scale consists of an equilateral triangle, whose base is subdivided in such a way as to show at once the orthographic projection of elements, located every 5 degrees, of cones and cylinders of any diameters, within the limits of the scale, when viewed in elevation.

In using this scale to find at once the position of the elements of cones or cylinders in the elevation; take the diameter on the edge of a strip of paper and fit it between the sides of the triangle, keeping it always parallel to the base, and then mark the points where the radial lines cut the strip. This strip can then be used on the drawing in the same manner as a scale.

This scale will save a great deal of labor in the drawing of patterns of articles formed of intersecting cones and cylinders; plans of cylinders, such as gear wheels; true representation of screw threads, etc.

As an illustration of the usefulness of these scales, Fig. 9 is given, which is a drawing of a pattern for an inclined cylinder.

The position of the elements shown in the elevation along *A B* can be determined directly by means of the universal scale, Fig. 8. The length of the semi-circumference of the cylinder, the line *C D*, can be determined by use of the universal scale, Fig. 7, and the points of subdivision of line *C D* by use of universal scale, Fig. 5.

While the results obtained by the use of

these universal scales are only graphical constructions—*i. e.*, approximate results—so at the best are the results from the application of geometrical constructions; and in work to which the scales can be applied, their use will effect a great saving of time, and the results obtained will be accurate enough for all practical purposes.

I have devised several other scales based on the same principle, but those explained above are the most important.

One other might be briefly mentioned. It consists of a triangle whose base is divided logarithmically, *i. e.*, similar to a slide-rule scale; hence, a means of subdividing any line of known or unknown length logarithmically.

Baron De Hirsch Trade School, New York.

The Best Tool for Heavy Cuts in Steel.

Concerning the work to be done by the tools sketched in our issue No. 1 of the present year, with an inquiry addressed to our readers as to which form of tool was best, some additional data have come to hand as to the work upon which the tools were to be employed. Over all length of shaft, 17 feet 6 inches; average diameter, 1 foot 4 inches; diameters of coupling flanges and thrust collars, 2 feet 6 inches; weight of rough forging, ingot steel, 9 tons 6 cwt.; weight of finished shaft, 6 tons 3 cwt. As thus 3 tons 3 cwt. of chips were to be cut from the single shaft, the responsibility of the tool is evident. We should add that the inquiry came to us from England.

A Milling Jig for the Speed Lathe.

BY JOSEPH V. WOODWORTH.

The jig here shown was used for milling the side at *T* of the piece shown in Fig. 2, which was made in the screw machine. After the casting *A* for the base was planed on both sides, the two holes *Q Q* were drilled for fastening it to the lathe. The swivel stud *C*, of machine steel, was then made, the case *B*, of cast iron, was turned and bored to allow *C* to move freely within it. A ¼-inch slot ¾ inch deep was milled through the center of the top of *C* for the jig lever *F*. The case *B* with the stud *C* was then fastened to the base *A* by four screws. A casting *E* was planed and the vertical slot for the lever *F* to move in was worked out to fit the lever nicely sideways. An opening was cut away at the further side as indicated by dotted lines at *H* for an outlet sidewise for the lever. The hole for the adjusting screw *J* was then drilled and tapped in the top and the casting fastened to the front of *A* by screws, leaving the slot for the lever in line with the center of the stud *C*. The lever *F* was then placed in the slot in *C* and a hole was drilled through them both for the pin *G*, which was tight in *C* and free in *F*. The large parts of the jig being complete, the piece for locating and holding the work was made. The pieces, Fig. 2, were all made in the turret lathe. The groove *R* around the outside of the piece was as near a perfect half-circle as it was possible to get it, and about 5-64 inch radius. At first a piece of machine steel was worked down to the shape shown by the outside of *K*. This was then fastened to the side of the lever *F* by screws and dowel pins. A hole was then drilled in the center of this at *M* just the size of the work around the body, this hole cutting partly into *F*, as shown, the shape of a small portion of the head of the work was worked out, allowing the work to rest nicely within it. The distance from the center of the work to the center of the groove *R* was then found and the centers located on the side of the lever *F* and two holes drilled through the lever and the piece *K*, cutting half-way into the hole *M*. Two pieces of Stubs steel, *N N*, 5-32 inch in diameter and the proper length, rounded off at the ends, were fastened into a flat steel piece, *O*, so that they would just enter the two holes at *N N*. A roundhead thumb-screw *W* was let in at *P*, enabling this piece to be inserted and withdrawn readily.

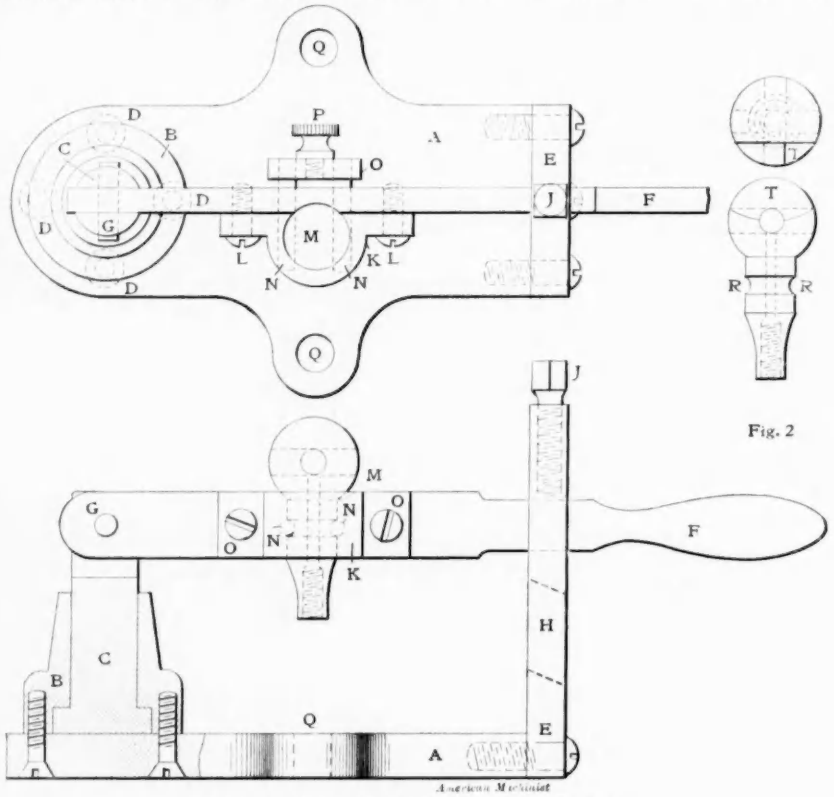


Fig. 2

FIG. 1. A MILLING JIG FOR THE SPEED LATHE.

The jig being complete, it was fastened to the lathe crossways and a cutter placed on a mandrel between the centers. The jig was then placed so that the work would come central one way, and off to the side the proper distance the other way. The lever *F* was dropped down and moved sideways out through the opening *H*. This left the part for the work to go in clear of the cutter. The work was then inserted and the lock pins *N N* were thrust in, thereby binding the work securely. The lever was then re-entered into the slot *H* and raised to a hight sufficient to mill the work to the proper depth, when the top of the lever encountered the stop screw *J*. We did quite a variety of different milling and cutting of this kind with this jig.

Fitting up a Brass Foundry.

BY C. VICKERS.

The most important things in designing a building to be used for a brass foundry are light and ventilation. Insufficient ventilation will permit the gases from the furnaces and the fumes from the metal to be retained in the shop, the men becoming drowsy and languid, and consequently doing less work, while a dark shop means a large gas bll. A shop built on the ground will allow the furnaces to be placed in a pit, and this is a distinct advantage. Receptacles for sand and fuel should be thought of and placed where they can be easily got at, both in winter and summer.

In this article, the internal arrangement of a brass foundry, rather than the building, will be considered, the idea being to furnish parties desirous of starting a small jobbing foundry with instructions that will enable them to build the molding troughs, lay the casting floor and skimming hearth, arrange the furnaces, emery wheels, tumbling barrels, etc.

In large cities brass foundries are often found in the upper stories of power buildings, and we will suppose we have rented a room or loft, on the top floor of such a

building, and that we contemplate doing sufficient business to run six molders. We first decide upon the position of the furnaces and locate them at the end of the room nearest the elevator. We next consider the position of the molding tubs, whether to arrange them along the wall or place them back to back at right angles to the wall. Where there is abundance of room the plan usually followed is to range them along the walls next the windows. We require six tubs, each not less than 9 feet in length, and if we can make them 10 feet so much the better, for when the tubs are too small the molder is always short of sand, is continually riddling and has to use it hot, which makes it stick to the patterns and cause the castings to look rough; so we will make the tubs, say, 10 feet in length by 24 inches deep, 24 inches wide at the bottom and 28 inches at the top. For each tub we shall require six dressed pine planks 2¼ inches thick by 12 inches wide, and four of them 10 feet and two 10 feet 4½ inches long. The front of the tub, where the molder will stand, is made sloping. Four pieces of plank 34 inches long are sawn for the ends. We are to cut grooves in these ends, into which the ends of the back and front planks will fit, thus holding them more securely against the pressure of the sand; so we lay two of the pieces on the floor, and, leaving an inch margin, mark out a two-inch straight groove for the back; the groove for the front is given a slope of four inches from bottom to top. Cut the grooves ½ inch deep and then spike the ends in position. We have now a rectangular bottomless box; we turn it bottom up and nail on the long planks, which are of sufficient length to reach across the ends. We then place the tubs in the position we have decided they are to occupy. They are raised from the floor six or eight inches by setting them on bricks or wood of that hight.

If the tubs are to stand by the wall, they are placed one foot away from the same. This will allow a tool shelf 12 inches wide to be nailed on the top edge of the back of the tub. This will project over and touch the wall and should have a ledge two inches high, fastened along that edge to prevent tools from falling off. Each tub must be provided inside with a ledge, back and front, to support the skids on which the molding is done. These ledges are simply "two by fours" and run the length of the tub. Nail the front one on first, 6 inches below the top of the tub; it will be easy then to determine the hight of the back one. Now, saw off for each tub two skids 2x4 inches, bevel one end to conform to the slope of the front of the tub; do not nail or fasten these skids in any way, as the molder adjusts them when he is working on any part of the tub that suits his convenience and generally removes them altogether when he riddles his sand.

The molding tubs are now complete, the next thing to be considered is the casting floor. This is best made of brick, confined within a defined space by "two by fours" nailed to the floor. This brick casting floor is not carried under the molders' feet because it is not necessary, and also is not a nice thing to stand upon. The "two by fours" are nailed down parallel with the front of the tubs and three feet distant. The space between the tub and the raised casting floor retains the sand spilled in molding and prevents it being distributed all over the shop. The whole space decided upon for casting is bounded by "two by fours" spiked to the floor. The bricks are then laid flat, breaking joints; they are bedded on sand ½ inch deep and dry sand is swept into the interstices. This brick floor should be extended to, under and around the furnaces so that if metal is spilled, fire will not result.

We are supposing that the furnaces are to stand on the floor like stoves; before laying the brick under them and along the floor adjacent, we first lay down a layer of asbestos paper. The fire regulations in some cities prescribe; first asbestos paper, on this a layer of hollow tiles and then a layer of common brick, on which the furnaces are set. When the furnaces are set each in a shallow cast-iron tray with feet two inches high, the hollow tiles are not necessary.

The part of the floor whereon the pots are to be skimmed should be carefully protected. Lay down several thicknesses of asbestos paper under the common brick at this spot, then on top of the brick floor make a "hearth." Get a tire from a wagon wheel with a three-inch face, lay it on the floor and fill it in with fire-brick cemented with fire-clay. The tire retains the brick in place. This hearth should be located six or eight feet away from the furnaces and centrally thereto. If the tubs have been placed at right angles, or with their ends abutting on the wall, casting floors are generally provided for every two molders. Two tubs are placed back to back with a space of 12 inches between; this allows for the tool shelf, which is fastened on the top of each tub, bridging this space and holding the tub together. Before this shelf is nailed on, a piece of "two by four" is fastened vertically on the back of each tub. It extends three feet above the top edge of the tubs near the end at the right of each molder. This is a convenience for hanging the sieve. Between the fronts of each set of tubs, there is a space of ten feet; this allows a casting floor six feet wide and a space of two feet before each tub where the molder stands. These casting floors should merge into a pathway of brick running along the ends of the tubs and reaching to the furnaces; sometimes the tubs are placed closer together and this pathway used for a casting floor.

The arrangement for illumination consists of a gas pipe suspended from the ceiling reaching down to within two feet of each tool shelf, midway of each set of tubs. To this pipe, two swivel brackets are attached, one for each molder.

The core bench and oven are sometimes located between the furnaces and the nearest molder. The bench is simply a stout table about 36 inches high, 36 inches wide and any length thought desirable. It is provided with back and sides 12 inches high. The core oven may be an elaborate affair or simply a rectangular iron box fitted with doors and set over the body of a small cannon stove. The stove-pipe is carried from the top of the oven to the chimney and should be provided with a damper. Angle iron is riveted at each end inside the oven and forms ledges to support the iron strips which are the shelves on which core plates are supported.

The emery wheels, tumbling barrels and casting cleaning bench are preferably located at the same end of the shop as the furnaces, near the elevator, for shipping conveniences.

The office of such a shop as we have been considering is usually not a pretentious affair. A space around the door is generally boxed in and provided with a roll-top desk, a telephone, safe, and book-keeper. Sometimes the office is divided by a counter before which customers stand. When visitors are undesirable, the space between the end of the counter and the wall of the office is fitted with a gate through which the employees pass.

For ventilation, square cupolas with skylights are sometimes provided. One of these should be placed directly over the furnaces and one or more over the casting floor. These cupolas ought to be at least four feet high, and provided on the sides with lattices or doors opening outward and operated from the inside. A cheaper way, sometimes practiced, is to cut out a portion of a roof ten feet in length and the width of two joists. Thieves are guarded against by running ½-inch iron bars lengthwise of the opening the same as prison windows are protected; the opening is bounded outside by a ledge over which a waterproof lid can be fitted at night time and in stormy weather.

Proper attention to the size of the flues will prevent noxious gases from being thrown into the shop from the furnaces; if any gas is noticed, enlarge the flues. This is an item too often neglected. It has a direct bearing on the health of the employees, and consequently on the cost of production, and should receive careful attention.

A German Defence of German Heavy Tools.

Under this heading the Cologne "Gazette," in a recent issue, publishes an article, an abstract of which will doubtless be of interest to the majority of our readers. Says the "Gazette":

We have received a communication

from industrial circles, in which reference is made to the growing importance of the German machine-tool industry. The writer points out that this branch of the German machinery industry had not been started in large shops especially built for the manufacture of machine tools, as is the case in the United States, and that it had not had at its disposal the immense sums of money invested in this line in America; on the other hand, the writer says that German tools, as far as quality is concerned, can not only successfully compete with American tools, but are in many instances superior. If a prejudice against German tools still prevails in misinformed manufacturing circles, and if those manufacturers prefer the American makes, this can only be traced to the systematic advertising methods carried on by the American machine-tool makers. The letter addressed to us refers particularly to advertisements of the German Niles Machine Tool Works, of Oberschönweide, near Berlin, and stamps some of the remarks, and especially the statement that there is no efficient competition on the continent, as an absolutely unfounded exaggeration and an absurd self-delusion.

Against this statement attention is called to the fact that the German machine-tool industry, especially in so far as the building of heavy machines for general machine construction and for iron and steel working is concerned, is fully up to date and able to meet the requirements of the market in every respect. The great German steel works, the "Gazette's" correspondent continues, use almost exclusively German machines, and the products of these works, he says, can beat any foreign competition. "Where," the writer exclaims with indignation, "are the heavy machine tools which cannot be beaten by any German makes to be found in the great works on the Lower Rhine and in Westphalia, in Silesia, on the Saar and in Southern Germany?" He then informs us that of American tools, for the most part, only small and medium-sized machines, such as are required in the manufacture of parts of the smaller dimensions, are used in German works, and he is courteous enough to admit that they are good; but at the same time he objects to their light construction. The extensive use of this class of American machine tools, the gentleman continues, is partly explained by the easy way in which they can be obtained, which he traces to the "massen-production" in the United States and to the intense commercial activity displayed for the sale of these tools, and, last but not least, to the fact that during recent years German works have been crowded with home and foreign orders, thus having been obliged to ask in many instances for long terms of delivery, as a result of which many orders went to America which under normal conditions would have been placed with German machine tool makers. The writer then goes on to say that now, after the extensive reconstruction and enlargements of the German machine-tool works, conditions are changed, and that the demand for the foreign article has largely decreased. Our friend then draws attention to the economical importance of the German machine-tool industry, which, he says, has been brought to light by the investigations made by the Society of German Machine Tool Builders on the occasion of the preparation of the new customs tariff. "Within the entire German machinery industry," the writer says, "the manufactures of machine tools occupy a prominent position. The annual value of the total German machinery production amounts to about 1,000,000,000 marks," he continues, "and 12 per cent. of this production is the output of the German machine-tool works. Of the latter, fully one-fourth is sold abroad in competition with foreign tools, which would not be possible if the German machines were not as good as any other makes." The writer then concludes his remarks by appealing to the patriotism of the German machine-tool users, asking them to meet German tools without any prejudice.

It was only recently that the "American Machinist" published a leading article, which appeared some time ago in the columns of the Cologne "Gazette," and in which the latter recognized the superiority of the American makes. As long as our German customers are satisfied with our tools, remarks like the above need not hurt our feelings. I have all respect for the German industry and the efficiency of the German engineering works, but I cannot refrain from saying that we excel, nevertheless, in the manufacture of machine tools, no matter whether they are small, medium or heavy. H. L. G.

Letters from Practical Men

A Large Perforating Press.

Editor American Machinist:

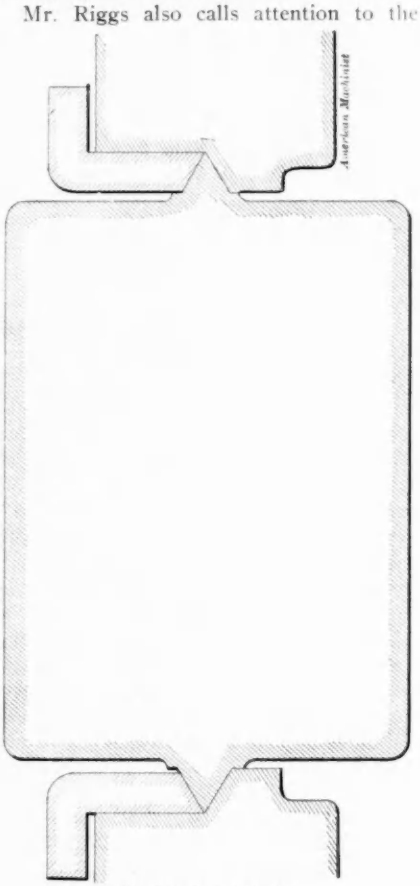
Permit me to reply to the article in your issue No. 51, 1900, page 43, and signed by John D. Riggs.

Referring to the large perforating press in question, the bearings on the sides of the slides running from front to back are 27 inches in width instead of 36 inches, and the bearings on the front and back and on the four corners of the slide are 4½ inches in width, instead of 3 inches, as Mr. Riggs, by his remarks, would lead one to believe. The area of the face of this slide is 65 inches right to left, 36 inches front to back, and as the press was constructed for the use of very large compound dies, that were expected to perforate a great number of holes, and at the same time cut out a complete blank, the cutting edge to be protected on the dies was very great.

Some of your readers would very quickly see the advantages of a slide of this area, constructed for dies of this character, having bearings on the four corners in addition to the right and left-hand sides of the slide. Bearings so constructed reduce the chances of the slide shifting, and thus causing damage to the dies. The old method was to have a V-shaped bearing centrally located on the slide at each end. One can very readily see the immense surface that the V-shaped bearings are expected to control and the advantages to be gained over the V-shaped construction, by the construction we have illustrated.

The reason that two pitmans are used on slides of large area instead of one pitman is to more evenly distribute the pressure over the surface of the slide and to prevent any deflection in the slide or cramping in its bearings.

Mr. Riggs also calls attention to the



OLD STYLE V-SLIDES.

construction of the pitmans. The pressure to be exerted by this press is 600 tons. The load to be lifted by the pitmans when the slide is on its upward stroke is less than 6 tons. This we believe is all that need be said in defense of a construction which gives greater strength on the downward than on the upward stroke.

The great advantage in cutting away a little of the under side of the pitman is, to have the upper side of the pitman bear on the shaft or pin directly above the solid metal of the slide, in this manner eliminating entirely the shearing strain to which the shaft would otherwise be subjected.

Mr. Riggs has illustrated a pitman which was, as he claims, illustrated by this company some ten years ago. In the natural

course of modern machine-tool building, we do not think it remarkable that we should attempt to improve on points of construction.

Last year one of our large American tool manufacturers visited England, and an English manufacturer had a small lathe of which he was exceptionally proud, and in exhibiting it to the American manufacturer he made the statement that the only thing about the lathe he had changed in the last twenty years was the price. Unfortunately, the American manufacturer, if following this plan, could not dispose of his tools.

You will see by referring to the illustrations in the issue just mentioned, that the shaft at the crank or upper portion of the pitman is very much larger than the pin or lower shaft, and that the lower shaft is expected, from the appearance of the cut, to withstand the same shearing strain as the upper shaft, and even with its four points of shearing contact it has not nearly the resistance that the top or crank shaft is capable of offering.

Referring to the remarks made by Mr. Riggs, of Prof. Sweet's statement, I will say that the theory advanced by Prof. Sweet is, we believe, correct; but in actual practice the user of the large press sometimes finds it desirable to have the bearings project downward as near to the cutting surface of the dies as possible, and no results detrimental to this form of construction have been discovered in the modern press.

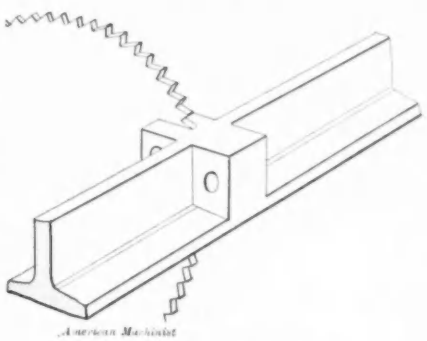
HENRY J. HINDE,
Supt. The Toledo Machine & Tool Co.

A Gang Die.

Editor American Machinist:

I send you a sketch of a die that "laps over" anything I have seen in that line for some time. The work produced is the cap used in oil-can spouts and it is put through seven operations, finishing the cap complete from the flat stock one for each stroke at the rate of 30 to 40,000 per day.

The stock is .025 inch low brass, and is stripped up to 1¼ inches wide and fed to the press with a roll feed in the usual manner. It is first cut by a punch on each end of the blank, as shown by the first and second punches in the gang.



NEW USE FOR AN OLD SAW.

This is to allow the metal to draw into the cup and still leave a margin to hold the cups together and feed them along for the next operation, the last one stamping and taking out all the wrinkles, and then it is trimmed out by the last punch. As it would take three or more operations to make the cup if done in the usual manner, it is easy for those interested in this kind of work to figure what the saving is.

The dies are used in a special heavy single-action power press with a roll feed and lifting devices to enable the cups to pass from one die to the next.

J. L. LUCAS.

Bridgeport, Conn.

A Saw Overcomes a Shipping Difficulty With Bars.

Editor American Machinist:

We were shipping a great many slender bars of cast iron several feet in length and consequently fragile.

They would mold easily, cool straight, and would finish readily, but, while they were abundantly strong for the work required, yet they would break in transportation. It did not seem advisable to increase the weight to a point where they would stand the abuse of improper handling since this would also add to the freight rates. It was finally decided to make the pattern in two pieces and bolt the castings together, even at the expense of finishing the two ends so as to make a good joint where they came together—no small job to do and keep the parts in line.

One suggestion led to another until finally it was decided to try the method shown in the sketch.

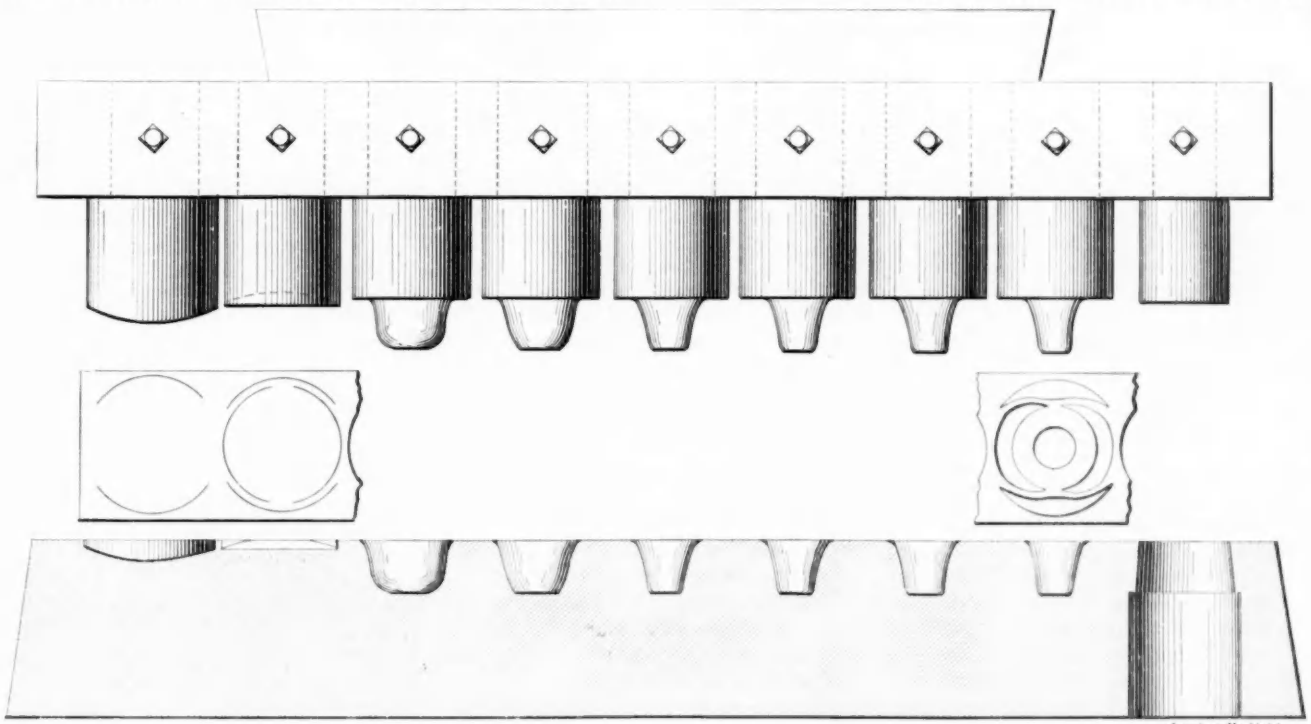
The bars were cast solid with a flange across the middle at which point they were cut apart by a cold saw, thus obviating all necessity for further finishing. The bars were, of course, just as much too short as the thickness of the saw and this amount was allowed for in making the pattern. It was found that in this manner they would stand transportation without breaking and when bolted together they would be of the right length and in line.

W. H. SARGENT.

Premiums to Workmen for Suggestions.

Editor American Machinist:

We are pleased to inform you that we introduced this system in October, 1899,



A GANG DIE.

as a result of reading your articles on the subject, and since that date have distributed upwards of £34 in premiums to our workmen. J. TYLOR & SONS, LTD.

London, England.

Index Cards for Patterns and Jigs.

Editor American Machinist:

We enclose herewith samples of cards which we have introduced here for indexing our patterns and jigs. These cards have been devised by Mr. Geo. Blair, one of our staff, and though similar to other cards illustrated in your journal they seem to us to be the most complete we have seen. At the same time they seem to be applicable to any manufacturing business requiring such an index to patterns and jigs, and hence a description may be of interest to your readers.

Every pattern made and every core box, etc., is marked with a symbol obtained from the drawing, this symbol being preferably used to designate a single piece throughout the whole process of manufacture. Two cards of different colors and called respectively *A* and *B* are filled out for each pattern indexed and they are filed in a special three-drawer cabinet, the drawers being marked "In," "Out" and "Under Repair." Card *A* is shown in Figs. 1 and 2; card *B* is like it, except that on the front side it reads at the bottom: "This card is to be handed into the store when the pattern is at the foundry and returned to the pattern shop when the pattern is returned," and on the rear side *B* has column rulings in which to note the number of castings required on successive orders, the material, the job and order numbers, the date, etc.

When the pattern is in the pattern store both cards are filed one behind the other in the drawer marked "In." When the pattern is at the foundry the card *A* is placed in the drawer "Out," the card *B* is sent to the receiving store and on the back of it are marked the requirements. As soon as the order for castings is filled and the pattern returned from the foundry, the card *B* is returned to the pattern shop with the pattern, which is again stored in its proper place and both cards placed in the drawer "In." The drawer "Under Repair" explains itself. The sketch of the pattern on the cards is a rough free-hand sketch sufficient to enable the pattern to be found by a laborer or boy and it also helps the storeman to recognize the castings as they are delivered. Tab cards can be inserted in the drawers to separate the patterns of one job from those of another.

The jig cards are shown in Figs. 3 and 4 and are filed in a cabinet in the jig store similar to the one used for the pattern cards.

While writing to you we take the opportunity of mentioning that the cards used by us for costing purposes are almost identical with those in use by Messrs. Fraser & Chalmers, described in your issues Nos. 44 and 45. The method of costing, checking with wages sheets, etc., and final filing away under symbols is exactly what we are about to introduce and was described in a paper on "Workshop Organization" read by our manager, Mr. Harold D. Jackson, before the West of Scotland Technical College Scientific Society on the 17th of November last.

Our business is that of makers of instruments, and it is interesting to see that a system which has served for the works of Messrs. Fraser & Chalmers is exactly what has been worked out quite independently to serve in our business which is so different in character.

We think the articles by Mr. Thomas, referred to above, are of great value to all interested in such subjects.

BARR & STROUD,
Per Harold D. Jackson.

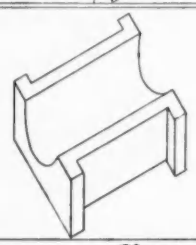
Glasgow, Scotland.

* SYMBOL: LM6.	PATTERN CARD.	A

NAME OF PART: Top Bush.

PATTERN MADE OF Beechwood.	DATE COMPLETED July 21st 1900.	
ORIGINALLY MADE TO DRG. No. 950. FOR S. O. No. 434.	CHECKED BY J. D. B.	STORED ON SHELF No. 47.

SKETCH OF PATTERN.



B & S M/11/00.

NO. OF COREBOXES WITH THIS PATTERN: None

NO. OFF FOR ONE MACHINE: 1.

* Each Pattern must have this Symbol marked upon it. This Card to be retained in the Pattern Shop.

American Machinist

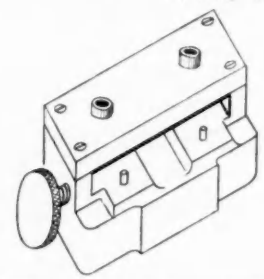
FIG. 1. PATTERN INDEX CARD A, FRONT SIDE.

* SYMBOL: RR25	JIG CARD.	* SHELF No. 13

JIG FOR Boring holes to receive terminals

ORIGINALLY MADE TO DRG. No. 847 FOR S. O. No. 368	CHECKED BY G3	DATE COMPLETED May 14, 1900

SKETCH OF JIG. MATERIAL. Cast Iron



B & S M/11/00.

FIRST USED FOR MACHINE No. 151	LAST USED FOR MACHINE No.

* These, together with the number of the first and last machines for which the jig was used, are to be plainly stamped on the jig or on a metal label attached to it.

American Machinist

FIG. 3. JIG INDEX CARD, FRONT SIDE.

LIST OF ALTERATIONS TO PATTERN NAMED ON OTHER SIDE.

NOTE OF ALTERATIONS OR REPAIR.	DATE.	DRG. No.	CHECKED BY
Length increased by $\frac{1}{4}$"	10-9-00	1123	JC
$\frac{1}{8}$" Removed from Length	16-10-00	1168	A J M.

American Machinist

FIG. 2. PATTERN INDEX CARD A, REAR SIDE.

LIST OF ALTERATIONS TO JIG NAMED ON OTHER SIDE.

NOTE OF ALTERATIONS OR REPAIRS.	DATE.	DRG. No.	CHECKED BY
Stop pins moved out $\frac{1}{16}$"	6-8-00	1015	JwS

American Machinist

FIG. 4. JIG INDEX CARD, REAR SIDE.

A Casting and How it Was Made.

Editor American Machinist:

I send you a sketch, Fig. 1, of a casting that we had to make and which we wished to make without cores, so that the sides would be of uniform thickness and so that the job would turn out smooth all over. This at first seemed not an easy thing to do, but Fig. 2 shows our way out of it, and it

will be seen that it was a very simple one. The loose piece in the end of the pattern was the key to the solution; if it was not, indeed, both lock and key. The pattern was stood on a board with the large end down and the drag was rammed up even with the top of the small end as it stood. The loose piece of the pattern was drawn out and the opening was covered with a small slab core. The drag was finished

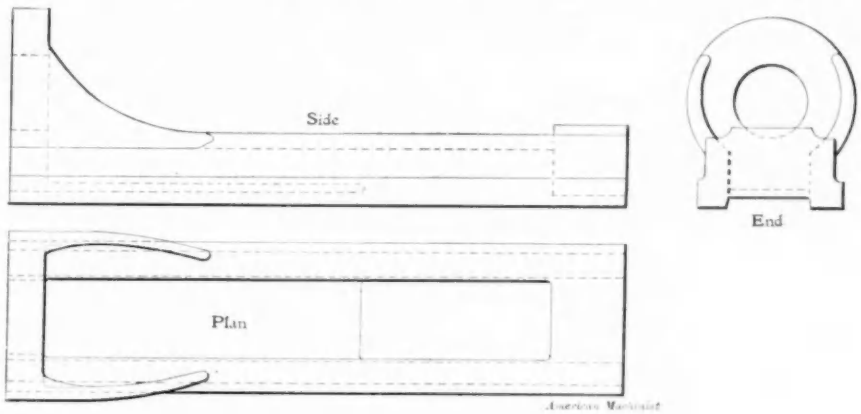


FIG. 1. A CASTING TO BE MADE. A MOLDER'S PROBLEM.

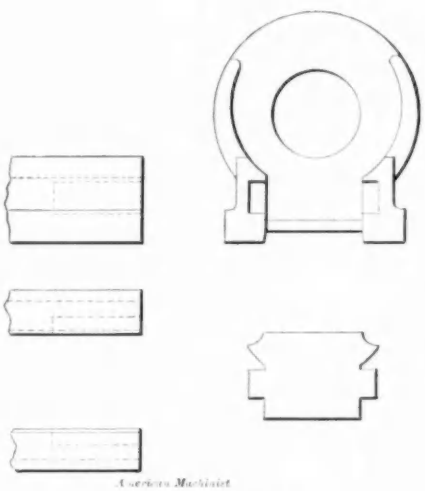


FIG. 2. SHOWING LOOSE PIECE IN PATTERN.

and rolled over, the cope rammed and taken off and the main pattern drawn, leaving the mold complete. This way of doing the job lets us have a simple and substantial pattern with a single loose piece and the simplest kind of a core. The molding operation was quick and simple and the casting could not have been better.

J. L. GARD.

Measuring the Flow of Water from Pipes.

Editor American Machinist:

In reading over the very practical and useful article, "Measuring the Flow of Water from Pipes," by W. H. Booth, in issue No. 52, I notice an error in the case of the vertical pipe that makes the final result one-fourth what it should be. On page 1229 he states very correctly that the initial velocity will be double the mean velocity (found to be 2 feet in .35 second), but says this will be 1 foot in .35 second instead of 4 feet in .35 second, as it should be. Four feet in .35 second equals about 11.3 feet per second, or 678 feet per minute as the velocity of flow from pipe. 678 feet = 226 yards; from the rule given in the article a 6-inch pipe will discharge 226 × 36 = 8,136 pounds per minute, or perhaps 800 imperial gallons per minute, if friction of pipe is considered. This gives 48,000 gallons per hour instead of 12,000. The velocity of flow can also be found from the well-known formula for falling bodies: $V = 32t = 32 \times .35 = 11.3$ nearly.

F. J. FOOTE.

Rectangular Emancipation—A New Radial Driller.

Editor American Machinist:

The article entitled "Rectangular Emancipation," in No. 50 of the "American Machinist," last year, in which an electrically driven radial drill is described, interests me very much, for the reason that more than a year ago I made the drawings for a drill which the description would fit very well.

In the shop with which I am connected we now have one of these drills under construction with motor for driving spindle, mounted directly on the sliding head, and motor for hoisting arm, on top of post.

I could not hope to improve on the admirable way in which our friend Tecumseh Swift presents the advantages of such a tool, but I hope soon to be able to show him a radial drill "emancipated" from a good many feet of shafting and several surplus gears.

C. E. WILLEY.

Louisville, Ky.

Co-operative Indexing—A Suggestion.

Editor American Machinist:

The article on "Indexing Periodical Literature," by Mr. D. T. Randall, in the "American Machinst" of December 27, has a melancholy interest for people who have tried, as I have, to "index periodical literature." The plan is all right; the trouble is that life is too short to carry it out.

Any busy man who tries to keep an up-to-date index of the articles that interest him (and it is the busy men who need indexes) will find, I think, that he cannot do that, and his reading and his daily work also. Consider the work involved in what Mr. Randall suggests. An index, he says truly, should give: (1) The title of the article; (2) the name of the author; (3) how many pages and how many illustrations; (4) a description of the article, giving the *real* subject and outlining its treatment; (5) a note regarding the value of the article, and (6) in what book or what periodical, in what volume and on what page, it may be found. When the busy man who sets out to do this himself has indexed, say, fifty articles in this manner, if he doesn't abandon his indexing operations, then I venture to guess that he is not really so busy as he thinks.

But, it may be suggested, he can get somebody else to do it for him; he can do the selecting, and have a clerk do the indexing. True—and such an index, narrow as its range may be, will no doubt be valuable to him. But note that it will cover only the ground that he has been over; it will simply make accessible for future use what he has already read. Now the chief use of an index is to find articles that one has not read—to show what literature exists on a certain subject, and where it may be found. All our feeble individual efforts in this direction, useful as they may be, are hopelessly inadequate; they do not begin to cover the ground.

What is needed is a complete Index to Technical Literature on a plan similar to that of Poole's Index to general periodical literature; and to get such an index (or rather *indexes*, for they are greatly needed in every department of business) what is required is co-operation. Poole's Index was made possible by the existence and organization of the American Library Association. If the various associations, colleges and technical schools interested in mechanical literature would take up the subject and join in planning and executing it, the result would be more valuable in a business sense than even Poole's Index, for the literature to be made available is business literature of really immense value. There are hundreds and perhaps thousands of business houses, colleges, technical schools, etc., to whom such an index, covering technical literature, American and foreign, for twenty years past, at a cost of, say, one hundred dollars, would be an exceedingly profitable investment. It would open to them a mine of wealth that is now for the most part buried out of sight. Ten minutes' use of such an index might easily disclose treasures of information which would more than pay the cost.

It may be that such indexes, more or

less complete, are already in existence. It is altogether likely that technical libraries or journals or clubs have made indexes of certain periodicals or books, or perhaps of publications in foreign languages. If such a work as I have suggested were undertaken, these partial indexes already existing could be used with important saving of labor; and the pioneers who have made such indexes would be just the ones to give valuable help and suggestions in making the work complete.

I wish to add that there seems to me one great defect in Poole's Index, which ought to be avoided in a technical index, namely, lack of fullness. In it no references to *authors* are given, so that one of the most important uses of an index, that is, to find all the articles by a certain writer, is impossible. Then also I think the subject index should be made very complete, even at the risk of making the work bulky; and under each subject heading suggestive references to other related headings should be given.

All these points, however, are matters of detail. The essential point is to realize the immense value of such an index of technical literature, the utter inadequacy of individual efforts, and the possibility of preparing by associated action an index which should be a worthy monument of the twentieth century. HENRY FERRIS.

Philadelphia, Pa.

Developing a Man-Hole Facing Machine

Editor American Machinist:

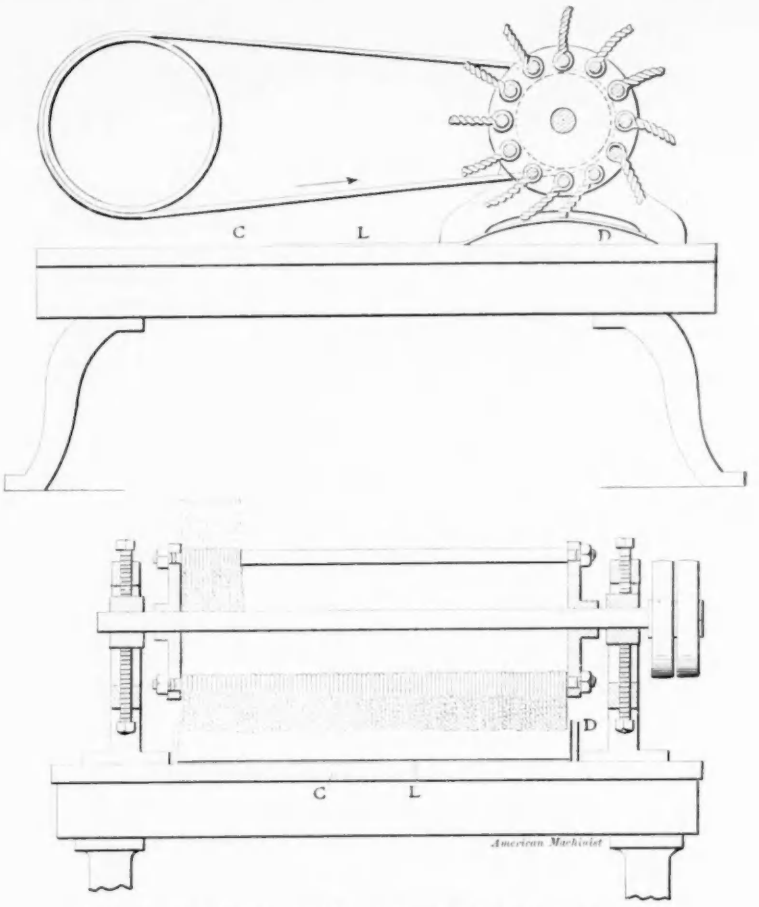
The article entitled "Developing a Man-Hole Facing Machine," by Mr. H. P. G. Norstrand, in your issue No. 50, last year, is fully covered in a patent issued to Peter Schellenbach. The number of the patent is 526,639. Several of these machines were built and sold and are now in operation, giving good results. Instead of the bevel-gear drive, as is shown by your correspondent, a double-pitch worm and worm-wheel were used. The flat cutter which he shows is used on this machine, also the same design of head on the handle. W. L. SCHELLENBACH.

Cincinnati, Ohio.

Some New Things.

COATING ONE METAL WITH ANOTHER BY WHIPPING OR BEATING.

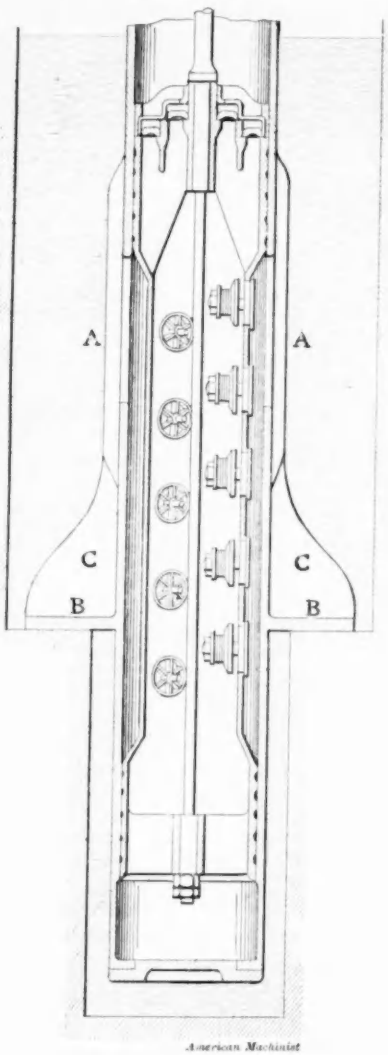
The accompanying cut is from a recently issued United States patent, and it shows, as will be easily understood, a method of coating one metal, as iron or steel, with another metal, as copper, by beating or whipping the latter into the surface of the former, the particles of the coating metal being driven into the pores or interstices and incorporated with the metal being coated. The surface to be covered must be absolutely clean to begin with, and then the second step is the systematic and continuous beating of the coating metal upon the metal to be coated. A rapidly revolving shaft has upon it two flanges. The peripheries of these flanges are connected by a number of equally spaced rods parallel with the shaft, and upon these rods are strung wire beaters, as shown, composed of the coating metal. The shaft carrying the beaters can be moved up or down by the screws as required to give the proper contact on the metal. *C* is the bed of the machine, and *L* is the plate or sheet of metal to be coated. It is moved by hand or otherwise over the raised portion *D*, so that the beaters strike every portion of the surface. It is claimed that the results obtained by this process are far superior to those of any other method of plating.



COATING ONE METAL WITH ANOTHER BY WHIPPING IT ON.

A NEW TYPE OF PUMP.

The accompanying cut, which we have adapted and re-engraved from "The Engineer," London, shows the construction and operation of a pump of novel design. It is not quite new, as several pumps of the type have been built and put into successful operation for the East London Water Company, with a diameter of 20½ inches and a stroke of 42 inches. The peculiarity and the peculiar advantage of the pump lie in the fact that all the valves are in the piston or plunger, so that when this is drawn up out of the pump barrel, everything requiring attention or repair is at once accessible. The barrel or case of the pump has a straight cylindrical bore, open at the top and closed at the bottom, but not continuous at *A*, where the upper and lower portions are connected by a number of external vertical lantern ribs, having large and free openings all around by which the water may flow into the barrel. The piston is long and hollow, with a portion at each end accurately fitting the pump barrel. The middle portion is smaller, with a number of spring-seated inlet valves distributed in rows up and down. The bottom of the piston is open, and the upper end is closed with double-beat delivery valves of large area. As the piston rises, the water above it is of course lifted, and at the same time water enters the piston through the valves at the side to fill the space at the bottom of the barrel left unoccupied by the rise of the piston. As the piston descends, the water below the piston flows up through it and passes the valve in the top, where, on the closing of the valve, it is held for the next lift. The flange *B* supports the weight of the barrel, the webs *C* assisting it. The stroke of the piston may be downward until it nearly strikes the bottom, and upward until the top of the lower fitting portion emerges from the top of the lower section of the barrel. This pump is the invention of Mr. Herbert Ashley, and is built by Glenfield & Kennedy, Limited, Kilmarnock.



A NEW TYPE OF PUMP.

Technical Graduates Wanted for Mint Apprentices.

The United States Civil Service Commission, Washington, D. C., announces that it is desired to establish an eligible register for the position of apprentice in the operating department of the United States mints, located at various cities throughout the country. Applicants must be graduates in metallurgy or mechanical engineering and chemistry from technical schools of recognized standing, and they must furnish in connection with their applications statements from officers of such schools, showing exactly the kind and character of work performed by them, and as to their efficiency in each branch. The term of services for apprentice shall be three years. Upon the completion of such term of service, the employee shall be eligible for appointment to any permanent position in the operating department in which the term of service has been served. The examination will consist of the following subjects: Certificate of graduation from technical school, 50 weights; thesis upon metallurgy, chemistry, mechanics, or some other appropriate topic, 25 weights; physical examination, 25 weights; total, 100 weights. The age limits are: Minimum, 18; maximum, 24. Persons who desire to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375 and special forms, which should be properly executed and filed with the Commission prior to the hour of closing business on February 17, 1901. The medical certificate in form 304 must be executed. The certificate of graduation, thesis, and other papers of recommendation should be filed with the application.

Personal.

F. V. M. Hudson, formerly secretary of the Hyatt Roller Bearing Company, has taken a position with Wm. J. Matheson & Co. (Ltd.), of New York, importers of dye stuffs and manufacturers of chemicals.

F. S. Weatherby, formerly of the Journal of Commerce Company, St. Louis, Mo., has been appointed Western representatitve of the "American Machinist" to succeed Mr. William R. Wallis, promoted to the position of advertising manager.

Our well-known and esteemed contributor, Wm. H. Booth, has become connected with the London house of Ldw. Loewe & Co., which, by the way, has (the London branch) been made a British limited company—*i. e.*, incorporated in England. H. L. F. Orcutt is Managing Director of the new company.

The American Bridge Company has made the following appointments: E. W. Stearns, manager of the East Berlin (Conn.) plant; Frank S. Moore, manager of the Lafayette (Ind.) plant; J. W. Walker, manager of all the Pittsburgh plants, which have been consolidated into one; C. A. Billings, assistant treasurer for the New York district, and H. W. Post, manager of the Post & McCord plant.

G. S. Boesch, under whose supervision will be the work at the new shop equipped for special machinery and tool building in Danbury, Conn., by the Boesch Manufacturing Company, has had an experience covering many years in important positions with the Brown & Sharpe Manufacturing Company, Winchester Repeating Arms Company, Pope Manufacturing Company and Blickensderfer Typewriter Company.

Clement Hackney, a mechanical engineer, died at Milwaukee, Wis., January 6, fifty-two years old. He was born in Lancashire, England, and was brought to live in Milwaukee when six years old. He was in the mechanical department of the Prairie du Chien division of the Chicago, Milwaukee & St. Paul Railroad for some time; later, under different owners, superintendent of the Bay View Mills, and, while still a comparatively young man, general superintendent of motive power of the Union Pacific road. For the past twelve years he had been general manager of the Fox Pressed Steel Company, with plants at Joliet, Ill., and Pittsburgh, with headquarters at Chicago.

Obituary.

William Seeker died in Brooklyn January 3, thirty years old. He was apprenticed to R. Hoe & Co. as a machinist at the age of fifteen, and when twenty-one he had charge of the erection of presses in the shop. He was in charge of the Hoe exhibit at the Columbian Exposition, and had set up new presses in many of the large cities.

Commodore Alexander Henderson, Chief Engineer, United States Navy, retired, died at Yonkers, N. Y., January 12, sixty-eight years old. He enered the navy as a Third Assistant Engineer in 1851, was in Commodore Perry's fleet which opened Japan to the civilized world in 1852 to 1855, and was in active service until his retirement for age, serving through the Civil War, being after that fleet engineer of the Asiatic and of the European stations, and in 1882 engineering head of the Naval Advisory Board, the first engines of the new navy being designed by him and built under his supervision. He was Chief Engineer of the Boston Navy Yard from 1889 to 1894, the year of his retirement. On leaving the navy he at once engaged in other business, and when the Spanish War broke out he volunteered and served as Fleet Engineer of the Auxiliary Navy.

The Buffalo Forge Company, during the first week of the year, held a meeting in Buffalo for its entire staff of traveling men and other officials. The gathering was devoted to interchange of ideas upon the technical and commercial aspects of the company's lines of business, such as heating, ventilating, drying, mechanical draft and forge installation. The company furnished hospitable entertainment and provided such diversions as a theater box party and a banquet.

The Cleveland Twist Drill Company, Cleveland, Ohio, send us a pamphlet entitled "Eleven Little Pictures." These pictures give views of their works and more particularly views showing features which have generally not been found in industrial establishments until within the past few years and which may be classed as among the recent developments. Among these are a view of the "dining room in action," the kitchen, in which food for the men's luncheons is prepared, view in the circulating library and in the reading room, picture of the mechanical drawing class in the night school, etc. The company informs us that it will send a copy to anyone who may be interested.

Manufacturers.

Material has been placed on the ground for the Mount Airy (N. C.) Furniture Company's new factory.

The Sun Electric Manufacturing Company is having plans made for a factory to be built at Camden, N. J.

John H. Miller's broom works, at Hamburg, Pa., recently destroyed by fire, will be rebuilt and the capacity increased.

Plans are under way for the erection of a plate mill building for the Maryland Tin Plate Company, at Cumberland, Md.

Citizens of Midland, Allegany County, Md., are organizing a home electric company. The plant is to cost about $8,000.

The Pfaltzgraff Stoneware Company, Limited, York, Pa., is preparing to build a three-story factory annex, 40x90 feet.

A flour mill of J. M. Berry, Augusta, Ga., has been burned, but will be rebuilt next fall. The insurance settled was $85,000.

Nashville parties have purchased the plant

(Continued on next page.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant : see p. 24.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

For Sale—Complete edition "A. M.," 11 vols., bound. L. F. Drescher, Circleville, O.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Parallel drawing-board attachments; by mail, $1.50; circulars. F. G. Hobart, Beloit,Wis.

Would like to correspond with patentees of improvements in grinding machinery. Box 1435, Providence, R. I.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Blueprints of gasoline carriage motor; all details and dimensions. Address Box 221, AMERICAN MACHINIST.

Send for circular of the Rich Handy Drawing Outfit; it is a great time-saver. J. & G. Rich, 120 N. 6th st., Philadelphia, Pa.

Drafting and designing quickly and accurately executed for firms not employing regular draftsmen, by Wallace & Co., P. O. Box 50, Newark, N. J.

$40,000 will secure estate's controlling interests in old-established and incorporated machine tool works, employing about 175 men. Box 218, AMERICAN MACHINIST.

Model, experimental, fine tool or any class of work wanted by fully equipped factory, centrally located in New York city; expert mechanics; estimates given; correspondence solicited. Box 208, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

A well-equipped machine shop and foundry, with ample water power, capacity 50 mechanics, tools suitable for engine building up to 24x24-inch or similar work, invites proposals in their line, or will consider manufacturing new specialties. Address P. O. Drawer, 414, Lockport, N. Y.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman wishes position. Box 234, AMERICAN MACHINIST.

Engineer and draftsman wants evening work, home or office; city. Box 209, AM. M.

Mechanical draftsman wants to change; 25 years; technical graduate; good experience on engine work. Box 220, AM. MACH.

Experienced designer of light machinery, tools and electrical apparatus wants employment. Address Box 204, AMER. MACHINIST.

Position designing and making jigs for interchangeable work; practical, experienced, sober, industrious; references. Box 229, A. M.

Wanted—By foundry foreman, foremanship of foundry making engine castings or general jobbing, heavy or light. Address Box 178, AMERICAN MACHINIST.

A reliable man, 35 years old, very successful designer, special machines, jigs and fixtures, will soon be open for a position. Box 213, AMERICAN MACHINIST.

Wanted—Situation, assisting engineer or master mechanic, by young man of technical education with 5 years' experience in mill work and engine construction. Box 210, A. M.

Assistant superintendent, now holding such position in shop manufacturing light interchangeable machinery, desires a change; can control work; references. Box 211, A. MACH.

Mechanical engineer desires change; technical education and 15 years' experience; specialist in mining machinery and steam engineering; excellent record. Box 214, A. MACH.

Expert designer of gasoline and steam automobiles, motors, etc., at present with prominent firm, wishes engagement with manufacturers of same. Box 228, AMER. MACHINIST.

A thorough, experienced, up-to-date machinist, who is also a good draftsman, with considerable technical knowledge, desires a change with opportunity of advancement. Box 226, AMERICAN MACHINIST.

Mechanical engineer, sober, reliable and competent, having had long experience in charge of men, machinery and power plants, desires a change of position. Address Box 227, AMERICAN MACHINIST.

Position as foreman wanted, by thorough machinist and toolmaker, used to building high-grade work by the interchangeable system; up-to-date tools and fixtures designed. Address Z. N., AMERICAN MACHINIST.

Technical graduate, 28, with 7 years' practical experience in shop and drawing room on mill and general machinery, tools, jigs and fixtures, desires position; familiar with best shop practice, estimating and systematizing; careful and energetic. Box 225, AM. MACH.

Wanted—Position as superintendent; capable of organizing and handling a machinery plant in all its branches; am a designer of special and automatic machinery, tools, jigs, fixtures for the rapid and economical production of interchangeable work. W. H. S., AMERICAN MACHINIST.

Position as foreman or superintendent by an all-round machinist and tool-maker, experienced on engine, electrical, machine tools, automatic machinery, also installing of machinery and up-to-date methods of getting out work; can successfully handle men. Box 212, AMERICAN MACHINIST.

Mechanical engineer with executive ability, knowledge of machinery and familiar with correspondence and office methods, now in charge of drafting room, desires managing position where capacity for handling men and directing work will be appreciated; Middle States. Box 216, AMERICAN MACHINIST.

Graduate mechanical engineer, 5 years' experience in installing all kinds of machinery and in superintending foundation work for the same, desires permanent position as assistant to or as mechanical engineer with a good manufacturing firm; A1 draftsman; best references; Pennsylvania or New Jersey preferred. Address Box 219, AMER. MACHINIST.

Help Wanted.

Wanted—Reliable draftsmen on special machinery; state experience and salary expected. Address "Buffalo," care AMER. MACHINIST.

Wanted—First-class draftsmen for punches and shears; state experience, age and salary expected. Address Box 233, AMER. MACH.

Superintendent wanted for gas-engine works employing 150 men; give full particulars as to experience, age, etc. Box 157, AMER. MACH.

Wanted—Immediately, two first-class draftsmen on hoisting machinery and engine work. Address A. B. C., care AMERICAN MACHINIST.

Wanted—Experienced draftsmen, familiar with steam hammer designs. Address Box 232, AMER. MACHINIST, with full particulars.

Wanted—Operator for Jones & Lamson turret machine; give experience and references. The Goulds Manufacturing Company, Seneca Falls, N. Y.

Wanted—Experienced traveling salesman; good theoretical and practical mechanical experience; references and terms required. Box 217, AMERICAN MACHINIST.

Wanted—Foreman for machine shop, acquainted with modern methods; state age, salary and last or present place employed. Box 222, AMERICAN MACHINIST.

Wanted—Draftsman for general work; graduate of technical school preferred; chance for young man to develop; locality, Worcester County. Address Box 203, AMER. MACH.

Wanted—Salesman experienced in machine tools and machinists' supplies, one having acquaintance with large Eastern buyers; state age, experience, etc. Box 215, AMER. MACH.

Wanted—Competent and experienced traveling salesman on machine tools; one who is acquainted with modern shop practice preferred. Address Box 196, AMER. MACHINIST.

Wanted—Competent draftsmen experienced in heavy machine tool designing; give experience, references and state salary that is expected. Address Box 231, AMER. MACHINIST.

Wanted—By new concern, an up-to-date mechanic as foreman; must be good toolmaker and experienced in gear cutting; good opportunity for advancement. Address Fawcus Machine Co., Pittsburgh, Pa.

Wanted—Machine tool salesman for cities of New York, Pittsburgh and Cleveland; local resident, acquainted with the trade, preferred; write, stating experience and giving references. Address Box 202, AMER. MACHINIST.

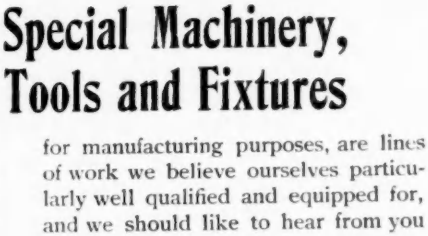
Wanted—Ten first-class toolmakers; must have experience on drill jigs, milling fixtures, gages and tools for interchangeable parts; all close work. Apply at once, National Cash Register Company, Employment Department, Dayton, Ohio.

We are enlarging our works, and will

Wanted Agency.

Party long established in business, with office on ground floor in machinery district New York city, would like to communicate with manufacturers of a line of machinery or tools, with a view of taking agency for same. Address "Agency," care AMERICAN MACHINIST, 218 William st., New York.

CLEVELAND GEAR WORKS,
W. R. SAWYER, Lessee.
86 SENECA STREET,
CLEVELAND, O.



GEARS of all descriptions.

Special Machinery, Tools and Fixtures

for manufacturing purposes, are lines of work we believe ourselves particularly well qualified and equipped for, and we should like to hear from you in reference to such before you place your next order.

Speaking of manufacturing, you can profitably use the **"Ideal" Reversing Tap Holder,** which we manufacture. Let us send you a descriptive circular.

Yours respectfully,

The Ideal Machine Works

Hartford, Conn., U. S. A.